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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

ORIGINAL ARTICLES

Cattle Breeding in the Argentine Republic at the Present Day

by

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NUMBERS OF CATTLE. — The 1908 census showed there were 29 124 336 cattle in the Argentine. Later, the number of head of cattle was calculated by means of the available statistical data : this showed that, in 1913, there were 30 706 447 animals. The results of the last census, which should appear shortly, are awaited with interest ; it will then be possible to judge whether, as has been asserted, the stock of cattle has been notably reduced by mortality due to years of drought, floods, epidemics, and, above all, to the slaughter of an excessive number of in-calf cows and of animals intended for exportation.

HISTORICAL DATA. — It is questionable whether there still exists a limited number of " pre-Columbian " horses (1) (i. e. horses existing in the country before the discovery of America by COLUMBUS), which may have transmitted their characters to certain animals of the " criolla " (Creole) breed. There is no ground for any such supposition with regard to the " criollos " cattle. It is, indeed, certain that there were no cattle in America when it was discovered, and that the Argentine cattle are descended from the Andalousian breed imported by the Spaniards at the beginning of their conquest. The cattle, like the horses, allowed to run wild, found in the pampas conditions generally favourable to their multiplication, increased rapidly, and filled the country. On the other hand, their increase was facilitated by the Spanish laws which, for a long time, hindered or even prevented completely, the free exportation of these animals and their

(1) See in *R.*, June 1917, p. 810, the article by the same author on *Horse breeding in the Argentine Republic at the present day*.

products, so that, owing to the smallness of the population, it was only possible to use them to a limited extent.

With time, the "criolla" race acquired distinct characters and, above all, a distinct development according to the environmental conditions in which it found itself in the different districts of the country, temperate or sub-tropical, flat or mountainous. In any case it may be said, generally speaking, that it excelled neither in the production of meat nor in that of milk, but at times only, in capacity for work.

The characteristics of the "criollos" cattle may be summarised as follows:

Animals symmetrical or otherwise, late in coming to maturity. Ample bone; head rather small; forehead broad, horns usually lyre-shaped, long, not very thick. The neck is short with well-marked dewlap. Upper line of trunk curved; croup short, oblique, angular; tail long, inserted fairly high and ending in a thick switch. Barrel well developed. Muscles of the upper parts of the limbs slightly developed. Coat, light or dark fawn with patches of colour. Muzzle, dark.

So long as local demands and requirements were limited, so long as the export trade consisted only in the sale of skins, suet and "tasajo" (salt meat), the "criolla" race did good service, and no necessity to replace it by others was felt. The position changed when the exportation, first of live animals, then of frozen meat, was started. For the manufacture of "tasajo" which for many years, was the only form in which meat was exported from Argentine, "novillos criollos" (creole steers) were used, chiefly because their relatively small amount of fat facilitated the preparation of the product. When, however, live animals began to be sent to England, the necessity was realised of producing material of a higher quality, which would meet the requirements of the new consumers and at the same time, by reason of its increased yield and earlier maturity, allow a greater interest to be made on the capital invested in this industry.

During the second half of the 19th century, therefore, breeding cattle of various British races began to be imported, their numbers increasing yearly. During the 15 years from 1900 to 1914 the following breeds were imported:

Breed	Number of animals	Breed	Number of animals
Shorthorn	10 650	Flemish	[illegible]
Hereford	583	Schwyz	3
Aberdeen Angus	468	Dutch	113
Red Polled	148	Dexter Kerry	[illegible]
Red Shorthorn	125	Other breeds*	[illegible]
Jersey	106		
		Total	12 460

* This includes the Sussex, Devon, Guernsey, Charolaise, Norman, Ayrshire, Galloway and Fribourg breeds.

The great preponderance of the Shorthorn breed over all others, including the Hereford and Aberdeen Angus breeds which, although almost equal in number, are yet much below the Shorthorn, is immediately ne-

ed. It is also remarkable that the greater part of the breeding stock nes from the United Kingdom, a fact which is dependant, not only on the incipal import and export tendencies, but also on special provisions with gard to the introduction of breeding cattle of non-British origin. On ny occasions these provisions have been temporarily suspended — during ernational exhibitions, etc. — and now they are being partly withdrawn.

The imported cattle were partly bred pure on the "cabañas" (stock ms) of the Argentine, and others, with their progeny, were used for pro-ssive crossing with the "criolla" breed. The most perfect specimens of se crosses are the so-called "puros por cruza" animals, which show no ce of the breed subjected to the crossing. There is a whole series of in-mediary grades between these animals and pure "criollos".

Tables I and II give data on the number of pure-bred and cross-bred ttle in the Argentine.

ABLE I. — *Cattle entered in the Argentine Herd Book up to the present day and from the 1st October 1915 to the 1st October 1916.*

Breed	Animals entered up to the present day			Animals entered from the 1st. Oct. 1915 to the 1st. Oct., 1916				
				Imported		Born in the country		Total
	Male	Female	Total	Male	Female	Male	Female	
ethorn	45 331	48 502	93 833	402	96	4 069	4 243	6 811
ford	8 613	10 794	19 407	13	—	514	566	1 123
rthen Angus	4 009	4 325	8 334	32	11	583	558	1 184
d Shorthorn	138	196	334	2	—	6	7	15
d Polled	99	112	211	—	—	13	12	25
ter	15	20	35	—	—	1	2	3
ss	35	42	78	2	5	10	9	26
rich	134	465	599	—	—	30	36	66
Total	58 374	66 457	122 831	451	112	5 266	5 424	11 253

TABLE II. *Different breeds of pure-bred and cross-bred cattle in the principal breeding provinces of the Argentine, in* 1908.

Breeds	Province of Buenos-Aires	Province of Santa Fé	Province of Entre Rios	Province of Corrientes	Province of Córdoba	Pampa	Whole of the Argentine
ithorn	1 560 067	636 805	914 140	311 768	415 478	150 278	1 385 880
ford	183 635	39 755	102 156	156 171	45 075	4 782	533 555
rthern Angus	58 523	3 161	11 911	5 000	5 111	1 125	125 829
ter	1 146	859	—	14	—	—	2 016
ss	1 702	—	—	—	—	—	1 702
d	12 871	4 002	671	208	2 030	—	21 164
rich	2 732	13	—	1	—	—	2 844
ed	1 828	570	—	—	—	—	2 401

TABLE III. — *Price (in paper pesos *) of breeding-stock sold at the exhibition of the "Sociedad Rural Argentina" in August, 1916.*

Breed		Animals entered	Animals sold	Price minimum	Price maximum	Price average
Shorthorn. .	"a galpón" 763 .	Males 681	583	900 *pesos*	50 000 *pesos*	3 600 *pesos*
		Females 82	26	900	3 700	1 585
	"palenque" 213 .	Males 203	170	700	4 200	1 785
		Females 10	5	950	1 150	1 110
Hereford . .	"a galpón" 116 .	Males 99	48	450	12 000	1 904
		Females 17	4	250	600	425
	"palenque" 15 .	Males	9	850	1 600	1 255
Aberdeen Angus	"a galpón" 86 .	Males 63	41	800	3 500	1 496
		Females 23	—	—	1 600	—
	"palenque" 10 .	Males	10	1 050	1 600	1 320
Red polled	2 .	Males	—	—	—	—
Flemish	7 .	Males	5	1 100	1 900	1 65
Jersey	5 .	Males 2	1	700	700	700
		Females 3	—	—	—	
Fribourg	8 .	Males	1	600	600	6
Dutch	20 .	Males 21	8	650	2 400	1 025
		Females 5	5	350	400	37
Dexter Kerry	2 .	Males 1	—	—	—	
		Female 1	—	—	—	
Norman.	2 .	Males			—	

Profit on sales: 204 500 *pesos*.

* 1 paper peso of the Argentine Republic = 1 s. 0 d.

According to Table II, the majority of the improved cattle are in the provinces of Buenos-Aires, Entre Ríos, Santa Fé, Corrientes, Córdoba and the Pampa. On the other hand, in the provinces of the north, those of the Andes and those of the south, the work of improving cattle is still in the fancy, and the "criolla" breed predominates.

RAISING. — With the exception of the "cabañes" bulls, the cattle are kept on open pasture land; both the animals kept in the "potreros" (enclosures) and those left free, live almost exclusively on natural pasture or alfalfa; it is very rarely they are fattened by being fed maize, crushed fodder, bran, etc.

A tribute of admiration and respect must be paid to the Argentine "cabañeros" (breeders) in recognition of their patriotism. The mission of the "cabañero" consists in importing the best breeding stock, for which

e sometimes pays exceedingly high prices, and breeding them on his own rms in order to sell their progeny and supply the pure-bred animals which re in constant demand for crossing. The sale price of this breeding stock is, n most cases, undoubtedly high, yet the expenses encurred in maintaining the "cabañas" are enormous, so that the profit made on the invested apital is often very low, and more than one "cabañero" has been obliged o retire from the trade. It is for this reason that the word "mission" as been intentionally used in connection with the work of these well-deerving citizens.

VALUE OF BREEDING STOCK. — Table III gives an idea of the prices ealised by breeding cattle sold at the Exhibition of the "Sociedad Rural rgentina" in August, 1916.

The sum of 50 000 *pesos* is not the highest paid for a Shorthorn bull, or "Americus", the champion of the 1913 Exhibition, was sold for 80 000 esos.

DISTRIBUTION OF THE PRINCIPAL BREEDING CATTLE. — At the present ay the Argentine possesses a large stock of Shorthorn breeding cattle of oth sexes, which will bear comparison with the best of those in the United ingdom; if desired, the Argentine could be completely independent where his breed is concerned. Hereford and Aberdeen Angus are also well repreented, though they have not yet, in every case, reached the same degree f excellence as the Shorthorns. For practical purposes, it is these three reeds which must be considered when studying the present state of the mprovement of Argentine cattle.

Shorthorns predominate in the richest and most temperate districts of he Argentine, and are found on the best "pastos tiernos" (tender pastures) nd "alfalfares" (alfalfa fields). Herefords and Aberdeen Angus are bred n the warmer or colder districts which produce pasture which is both less bundant and less good.

The marked predominance of the Shorthorn breed over all others may e explained by the fact that, hitherto, the export trade has been almost xclusively transacted in England. We believe, nevertheless, (and our pinion is shared by many breeders) that if, after the end of the war, new arkets open and develop on the European Continent, they will prefer the ore tasty and better marbled meat of the Hereford and Aberdeen Angus ross breeds, and this demand will cause a great increase in their production.

CARCASE WEIGHTS OF THE 3 PRINCIPAL BRITISH BREEDS. — Table IV ives the averages obtained by the LA PLATA COLD STORAGE COMPANY rom 1142 cattle from exhibitions of fat stock between 1910 and 1914.

Steers intended for cold storage do not, of course, normally weigh as uch as the animals mentioned in Table IV, a weight of from 600 to 650 g. at 3 years of age being considered satisfactory.

OBSTACLES TO THE IMPROVEMENT OF THE "CRIOLLA" RACE. — A ubious problem, the rational solution of which will have a large influence n the future of cattle breeding in practically the whole of northern Argenina, is the improvement of the "criollo" cattle.

TABLE IV. — *Average results obtained by the* LA PLATA COLD STORAGE COMPANY *from the slaughter of* 1142 *fat cattle of the Shorthorn, Hereford and Aberdeen Angus breeds.*

Categories and produce	Shorthorn	Hereford	Aberdeen Ang
Milk teeth:			
Live weight	518 kg (1)	—	479 kg
Net weight	324 kg	—	296 kg
Net weight in % of live weight	62.3 %	—	61.9
Fat	43.6 kg	—	33.0 kg
Skin	20.8 kg	—	34.4 kg
2 teeth:			
Live weight	611 kg	586 kg	—
Net weight	390 kg	387 kg	—
Net weight in % of live weight	64.8 %	65.1 %	—
Fat	51.7 kg	50.4 kg	—
Skin	30.5 kg	35.0 kg	—
4 teeth:			
Live weight	644 kg	669 kg	640 kg
Net weight	421 kg	404 kg	429 kg
Net weight in % of live weight	65.2 %	66.3 %	66.5 %
Fat	50.1 kg	49.5 kg	57.2 kg
Skin	31.0 kg	31.0 kg	29.5 kg
6 teeth:			
Live weight	773 kg	754 kg	741 kg
Net weight	510 kg	512 kg	474 kg
Net weight in % of live weight	66.0 %	67.8 %	65 %
Fat	59.5 kg	58.0 kg	57.0 kg
Skin	31.5 kg	37.7 kg	32.7 kg
Full mouth:			
Live weight	851 kg	851 kg	—
Net weight	503 kg	528 kg	—
Net weight in % of liv weight	60.1 %	65.1 %	—
Fat	62.7 kg	58.0 kg	—
Skin	36.0 kg	43.1 kg	—

(1) 1 kg = 2.2 lbs. (*Ed.*)

There are two important factors which greatly hinder such improvement — "tristeza" (bovine piroplasmosis), and the climate.

As is known, "tristeza" is an disease caused by a parasitic haematozoon, *Piroplasma bigeminum*, which lives in the red blood corpuscles. This disease, also called "Texas fever", "red-water", "bovine malaria" is, in some cases, sporadic and not very dangerous, but in others it is enzootic and as in the Argentine, causes great loss to breeders. In the infected districts, the "criollos" animals, and those which have been but slightly crossed, enjoy a natural relative immunity, but improved breeding stock when introduced are very susceptible to the fever, and from 50 to 90 % of

iem die. The disease is carried from sick to healthy animals by a tick (1), ie "garrapata" (*Boophilus microplus* Can.), which thrives particularly the hot districts, and in the "*pastos fuertes*", or natural pasture lands hard grasses of low food value.

In order to prevent the spread of "tristeza", the Argentine Government divided the country into 3 districts: — infected zone; intermediate ne; immune zone. To the first belongs nearly all the north of the untry, the second includes the southern parts of the provinces of Córdoba, nta Fé and Entre Ríos; the third includes the parts furthest south of the rovinces of Córdoba and Santa Fé and all the rest of the Republic. Before nimals may pass from the infected to the immune districts, they must be isinfected in the official anti-parasite "bañaderos", erected on the borders the 3 zones and must submit to precautions taken by the sanitary police. o satisfactory treatment has yet been discovered for "tristeza" but atmpts are made to fight it by burning the "pastos fuertes" from time time, by extending artificial meadow land and by immunising the cattle y vaccination with a weak virus.

On the other hand, the climate is also a negative factor detrimental to ie improvement of cattle in the north of the Argentine. It must not be rgotten that the pure-bred bulls which are imported nearly always come om temperate districts rich in good pasture-land. These animals, suddenly transferred to semi-tropical districts and given pasture of inferior uality, suffer greatly, waste away and thus very easily contract the eaded "tristeza".

If, therefore, the "criolla" breed is to be effectively improved, not only ust the measures already mentioned be applied and made yet more strict, ut the living conditions of the imported breeding-stock must be improved, that they may be acclimatised gradually, not suddenly. From this point view the establishment of a series of breeding stations would be of great portance. These would be placed at strategical distances apart, so to eak, and would be used for the successive breeding and production of eeding stock intended for the north of the country. By these means the ttle, when they reach their destination, will have largely overcome the cri- of adaptation to the new climatic and environmental conditions, and with ie help of inoculations and other suitable methods, they will be much betr able to resist the attacks of "tristeza" than they are at the present day.

While travelling in the north of the country we visited breeding farms here private individuals had followed this course on their own account, d had obtained very satisfactory results.

Besides the measures already mentioned, there is no doubt that others ight be adopted to the same end. In certain parts of the province of alta, the Chaco, etc. there are well-developed "criollos" cattle which a efe process of selection is capable of improving. In this case there would the great advantage of using animals already completely acclimatised.

1) See *B.* June, 1911, No. 1805; *B.* May 1912, No. 810; *B.* February 1913, No. 145; *B.* vember, 1914, No. 1019. (*Ed.*)

Moreover, there is no reason why Herefords and Aberdeen Angus shoul be the only breeds used for improving the " criolla " race by crossing. W have excellent groups of Devons, and Red Polled cattle might certain be tried, as well as other good outdoor non-English breeds, such as the Re magnola, Charolaise, etc. The breeding possibilities of the north are, there fore, immense. If there be taken into account the great water-ways whic allow easy communications with the chief ports of the Argentine, and th fact that, in many districts, there are two maize crops a year, it is easy t foretell the results which may be obtained when the population has increase and the methods of cultivation and breeding have been improved.

MEAT TRADE. — The exportation of live cattle and " tasajo ", whic originally, was of much greater importance than that of frozen and chille meat, was soon exceeded by this latter, as may be seen from Table V.

TABLE V. — *Exportation of live cattle, of meat and its derivatives, from* 1883 *to* 1914 *(in metric tons).*

Year	Live cattle	Frozen meat	« Tasajo »	Meat extracts and preserves	Total
1883	—	28	—	—	
1890	38 530	9 535	371 700	101 800	8[illegible] 9
1900	150 550	66 571	268 000	61 400	54[illegible]
1901	119 180	136 073	327 700	75 200	648
1902	118 303	207 553	330 000	141 300	8[illegible]
1903	181 800	254 971	152 [illegible]0	110 300	[illegible]
1904	120 275	304 033	150 [illegible]0	85 200	6[illegible]
1905	262 081	383 985	28[illegible] 00	127 900	1[illegible]
1906	71 100	500 037	100 800	181 000	8[illegible]
1907	4 841	441 [illegible]62	10[illegible] 300	202 [illegible]00	[illegible]
1908	60 910	5[illegible] 094	42 100	135 400	88[illegible]
1909	132 450	941 803	154 [illegible]00	185 100	1 113 [illegible]
1910	87 733	1 [illegible]24 005	155 [illegible] 0	259 [illegible]08	[illegible] 2 4
1911	184 [illegible]52	934 435	1 [illegible]0 [illegible]00	216 800	1 5[illegible]
1912	201 410	1 030 901	[illegible]20 800	253 [illegible]0 [illegible]	1 [illegible]71
1913	224 911	1 023 180	24 [illegible]00	253 200	1 5[illegible]
1914	115 550	1 100 [illegible]0	2 500	153 [illegible]00	1 [illegible]

The live cattle are chiefly sent to the markets of the South Americ Republics (Uruguay, Chili, Brazil, Bolivia, Paraguay), who receive the " tasa is chiefly exported to Cuba and Brazil, and the frozen meat to the Uni Kingdom.

Below is given the total number of cattle killed in the abattoirs, co storage slaughter-houses and " saladeros " (salt meat factories) during th years 1904, 1910 and 1914.

Year	Total number of cattle	Calves	Steers	Cows	
				Number	% of total
1904	1 450 032	105 [illegible]31	988 [illegible]21	351 307	26.6
1910	2 [illegible]55 250	301 [illegible]15	1 [illegible]51 [illegible]35	702 [illegible]80	23.3
1914	3 [illegible]11 185	135 [illegible]73	2 [illegible]51 [illegible]04	786 108	25.5

TABLE VI. — *Sale price of cattle at the Buenos-Aires abattoirs from 1888 to 1911 (in paper pesos).*

Category	1888	1890	1898	1904	1907	1909	1913	1915	1916
ll:									
cial	23–34	32–44	59–63	70–75	—	90–100	160–170	220–270	180–200
l	—	—	—	60–65	68–78	85–95	140–150	180–200	160–170
meat	—	—	—	52–56	60–66	70–80	120–130	170–180	130–140
d meat	—	—	39–42	48–50	—	60–70	100–110	120–150	110–120
ted Steers:									
cial	38–54	32–52	70–81	76–80	73–82	100–115	150–170	210–240	190–200
	25–38	16–28	45–54	60–65	68–72	90–95	130–150	170–190	160–180
meat	10–15	8–20	—	54–57	53–58	66–70	115–120	150–160	140–150
d meat	8–10	16	—	50–52	48–52	60–65	90–100	85–140	120–130
llos" Steers:									
	12–23	—	43–54	54–58	56–60	60–65	110–120	150–170	140–160
ted cows:									
cial	38–54	—	40–50	60–65	58–63	80–90	120–130	150–160	150–160
	15–38	20–28		46–54	52–58	70–75	95–100	120–130	130–140
meat	10–15	16–20	31–30	38–40	38–43	50–55	85–90	110–120	110–120
d meat	8–10	16	23–29	32–34	30–36	40–50	75–80	95–105	90–100
dos" cows:									
	—	—	—	40–45	38–44	50–55	80–90	110–120	100–110
d meat	8–10	5–7	21–23	27–30	26–33	30–35	70–75	80–90	80–90
ted Heifers:									
cial	—	—	—	36–40	40–46	40–50	100–110	120–130	120–130
	—	—	—	—	34–38	35–40	95–100	110–120	105–115
meat	—	—	—	24–28	26–33	28–33	80–85	90–100	85–95
dos" Heifers									
	—	—	—	—	—	—	70–75	90–100	80–85
meat	—	—	—	—	—	—	50–55	70–80	60–70
l	6–10	6–12	11–13	24–27	28–34	25–28	70–80	75–85	75–85
	—	—	—	18–20	22–26	20–22	55–60	65–70	60–70
dos									
	—	—	45	12–14	12–18	8–10	35–40	30–40	35–45
	3–5	—	—	8	8–10	—	20–30	25–35	20–30
lem	—	—	—	—	5–10	—	10–15	10–15	10–15

Many more cows are killed in the abattoirs than in the "saladeros" cold-storage slaughter-houses, as is shown by the average percentages the period 1904-1914: Abattoirs, 47.7 %; "saladeros", 13.3 %; cold ge, 4.74 %.

Table VI shows the prices realised in the Buenos-Aires "mataderos"

(abattoirs) according to the class, sex and age of the animals in spring a summer of a series of years since 1888.

If the prices of 1888-1890 are compared with those of 1913 (before t war) an enormous difference is noticed, the figures of 1913 being sometim ten times as great as those of 1888-1890. This has become still more mark since the war; thus, certain exceptional lots of steers have realised as muc as 300 *pesos* per head.

PRODUCTION OF MILK AND ITS DERIVATIVES:

According to the 1908 census, 2 163 900 dairy cows were in milk; the Argentine; about 800 000 of these were of the Shorthorn breed.

The average milk yield per cow is relatively very low, barely exceedi 1000 litres per annum. There are, of course, farms which produce more t there are cows capable of giving 20 litres of milk or more per day, but as rule, the above-mentioned yield is obtained. This low production is due many causes; foremost among these are the life in the open pasture las (influence of changes of temperature, sun, wind, insects, etc.), lack of food reserves, lack of suitable morpho-physiological selection, etc.

It is true that there are other breeds more specialised in milk-producti than the Shorthorn. Considering, however, the special local conditions, wh the main object is invariably meat-production, and considering also th certain Shorthorn cows are capable of giving as much as 4000 litres of mi a year, there is no reason why the present conditions should not be i proved. It would be possible to raise the milk yield to 2500-3000 litres p cow by adopting the following methods: the use of good bulls of dairy fam lies; suitable selection of cows; more careful and more uniform feedin shelter against climatic conditions.

Intensive individual production of large quantities of milk will only b possible in the Argentine in the far future, when an increased populatio will give rise to many small farms, capable of supplying varied and abunda food to a small number of animals kept, either on the mixed system (c pasture and shippons), or exclusively in shippons. At the present day i most cases, dairy herds are kept by landed proprietors, who divide them in groups of 50 or 60 animals forming a "tambo", tended by a famil usually of Basque extraction. If, for each "tambo", a certain area fodder destined to act as reserve food at critical times were cultivated a certain commodities were supplied for the animals, great progress wo already be made. Unfortunately, except on rare occasions, the divisi of cows into small groups is seldom accompanied by any intensification the conditions under which they are kept.

On the other hand, the high prices realised by animals for the butch have given a new blow to the already tottering dairy industry, and the gre drought of 1916 brought about a real crisis.

Nevertheless, we are convinced that it is only a question of time, an that the present stagnation will be followed by a period of great activit and prosperity.

All the district near the coast and the rivers presents conditions ver favourable to the dairy industry; this also applies to the mountainous r

TABLE VII. — *Production and number of establishments engaged in the dairy industry from* 1903 *to* 1915.

Year	Number of establishments				Production		
	Milk dairies	Butter dairies	Cheese dairies	Mixed dairies	Butter	Cheese	Casein
903	224	14	48	38	8 835 039 kg	1 087 997 kg	—
905	282	26	78	40	8 833 881	1 950 401	—
907	409	29	85	56	6 727 988	1 870 802	—
909	545	18	111	185	7 151 647	3 084 261	—
911	398	10	158	329	7 904 981	3 513 524	—
913	516	8	128	367	9 457 201	5 425 989	5 334 910 kg
913	462	9	131	323	10 197 752	5 689 421	6 729 341
914	502	21	299	470	8 834 572	6 779 397	4 729 341

TABLE VIII. — *Production, consumption, importation and exportation of butter and cheese from* 1903 *to* 1915.

	Year	Production	Importation	Exportation	Total consumption	Per head consumption
Butter	1903 . .	8 835 039 kg	—	5 330 140 kg	3 504 899 kg	0.097 kg
	1905 . .	8 833 881	—	5 393 233	3 440 828	0.012
	1909 . .	7 151 647	—	3 992 724	3 158 913	0.464
	1911 . .	7 904 981	—	1 396 000	6 508 981	0.871
	1913 . .	10 197 752	—	3 784 000	6 413 752	0 802
	1915 . .	8 834 572	—	4 623 000	4 211 572	0.600
Cheese	1903 . .	1 087 998 kg	1 129 304 kg	3 899 kg	2 313 403 kg	0.460 kg
	1905 . .	1 950 401	1 020 700	2 452	3 868 739	0.612
	1909 . .	3 084 261	4 030 057	—	7 114 318	0.945
	1911 . .	3 512 524	4 919 437	518	8 432 443	1.129
	1913 . .	5 689 421	5 045 040	7 342	10 727 119	1.344

gions of Neuquén and Salta, while good results may also be obtained in the interior. In suitable districts attempts might be made to keep the European alpine types and increase the herds of Dutch cattle, which have given excellent results, because, like the Jersey breed, they may profitably be kept in the open.

In the south of the Argentine, Aberdeen Angus cows giving good milk yields (as much as 20 litres per day per animal) have been observed. This is is of great interest in view of the suitability of this breed to open-air life and its capacity for meat production.

It is, of course, necessary that the Government, on its side, should face

litate the development of this industry by means of new roadways and ra ways, the reduction of tariff refrigerating cars, etc.

Table VII summarises the data concerning the production and to number of establishments engaged in the dairy industry from 1903 to 19 Table VIII gives, for the same period, figures relating to the producti consumption, importation and exportation of butter and cheese.

Whereas the amount of butter made and its consumption per head ha not suffered any important variations, the exportation of this prod decreased greatly between 1909 and 1913.

On the other hand, the production and consumption of cheese ha increased continuously, and the consumption per head has risen from 0. kg. in 1903 to 1.344 kg. in 1913.

At the present day the following varieties of cheese are manufactur in the Argentine: -- Cheddar, Cheshire, Dutch, Fontina, Grana, etc. The are all of excellent quality and there is no doubt that, before long, it wi not only be possible to dispense with cheese imported from Europe, but ev to export it in large quantities.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

(9) — **Agricultural and Economical Development of Venezuela.** — DUHAUT, in the *Bulletin de l'Office de Renseignements agricoles du Ministère de l'Agriculture de France*, Year 15, October-November, 1916, pp. 441-453. Paris, 1916.

Venezuela, which has an area of about 424 710 square miles, is bounded on the north by the Carribean Sea, on the north-east by the Gulf of Paria and the Atlantic Ocean, on the east by British Guiana, on the south by Brazil and on the west by Columbia. The length of the coast is more than 1366 miles. It is watered by the Orinoco and the tributaries of Lake Maracaibo.

It has a population of 2 800 000 inhabitants (6.59 per square mile), not including the Indians, of whom it is impossible to take a census. The official language is Spanish; the most generally spoken foreign language, French.

DIVISION AND COST OF LAND. — The law of July 4, 1912, divided the land into two categories themselves sub-divided into two classes: 1) 1st. and 2nd. class agricultural land; 2) 1st. and 2nd. class pasture land.

The distinction between the two categories depends on the conditions of irrigation, exposure, temperature and vegetation, on the proximity to means of communication, the coast or an important town.

Land	Sale price		Rent		
1st. class agricultural land,	40 *bolivares* (1) and more	per hectare (2)	4 *bolivares*	1 *bolivar*	per hectare
2nd. class agricultural land,	25 *bolivares* and more				
1st. class pasture land,	2 000 *bolivares* and more	per 2 500 hectares	100 *bolivares*		per 25 square km. (3)
2nd. class pasture land,	1 200 *bolivares* and more		75	„	

(1) 1 *bolivar* = 9 1/8 d. at par. (2) 1 *hectare* = 2.47 acres. (3) 1 *square km.* = 0.381 square miles.

The conditions for purchasing large forest estates yielding natural products (gum, rubber, wood, etc.) are also fixed by law : — a minimum of 125 square km. and a maximum of 60 square km.

AGRICULTURAL DISTRICTS. — From an agricultural point of view Venezuela may be divided into 3 regions.

1) *Maritime region*, the true agricultural region (cocoa, coffee, sugar cane, banana, maize, vegetables, tobacco, and, in the higher land, wheat and vines) ;

2) *Breeding region*, in the plain of the Orinoco basin, occupying about $\frac{1}{3}$ of the total area (cattle, horses, goats).

3) *Forest district*, in the south (rubber, balata, building wood, cabinet woods, plants yielding tannin and dyes, vanilla, sandal-wood, tonca-beans, corozos, oil-nuts, etc.) .

Fibre plants are found in all 3 districts.

COMMUNICATIONS. — *Within the country.* — The Orinoco and its tributaries, navigable along the greater part of their length, form the chief natural inland means of communication. There are already a certain number of roads, and some railways. For the present these means of communication ae sufficient.

With abroad. — Venezuela is in direct and regular communication with the United States, Central America, France, England, Holland, Spain, Italy and the islands of the West Indies though the steamship lines of these countries. Before the war it was also connected with Germany by the German lines. The 5 principal ports are : La Guaira, Puerto Cabello, Maracaibo, Carupano and Ciudad-Bolivar : this last port is on the Orinoco about 186 miles from the mouth. The 6 secondary ports are : Cumana (Puerto-sucre), Guanta, Cristobal Colon, La Vela de Coro, Pampatar, the port of Margarita Island, and Barrancas, a river port on the Macareo branch of the Orinoco Delta.

AGRICULTURAL IMPORTS FROM EUROPE. — These only include agricultural and dairy produce, such as butter, cheese, wine, agricultural machines and implements, etc.

During the last 5 years before the war from 1909 to 1913 inclusive and during the first 7 months of the war, the total imports of Venezuela reached a value of 455 816 015 *bolivares*, of which 294 278 481 *bolivars* represent imports from Europe.

Details of imports from Europe.

England	115 413 000 *boliv.*	of which	5 017 000 *boliv.*	represent	agricultural	products
Germany	74 606 000	"	"	"	3 730 000	"	"	"
France	49 328 000	"	"	"	3 869 000	"	"	"
Holland	32 232 000	"	"	"	2 303 000	"	"	"
Spain	20 401 000	"	"	"	4 750 000	"	"	"
Italy	14 651 000	"	"	"	2 930 000	"	"	"

The rest of the imports from Europe are divided amongst Austria, Belgium, Denmark and Portugal.

Wine forms $^4/_5$ of the total agricultural exports from France ; the same plies to Spain and Italy.

England and Germany export chiefly agricultural implements.

AGRICULTURAL EXPORTS INTO EUROPE. — The total value of the Venezelan exports from 1909 to July 1st. 1914 was 538 160 157 *bolivares* which 412 856 649 *bolivares* were imported into Europe.

tails of exports into Europe, (agricultural products and their derivatives).

Imported into	France.	203 179 000	*bolivares*
" "	Germany.	97 807 000	"
" "	England	51 743 000	"
" "	Spain	32 046 000	"
" "	Holland	23 976 000	"
" "	Italy	6 490 000	"

SLIGHTLY DEVELOPED AND UNDEVELOPED RESOURCES. — Most of the oducts of the soil or the sub-soil of Venezuela are either not undeveloped only slightly so. This is not due, as has been stated, either to lack of ans of communication or to diseases of cattle.

These products may be divided into 2 groups : *A*) those which may be t to immediate use, and may satisfy the requirements of the present day after the war ; *B*) those which cannot be put to use for some time, and ich require a more or less lengthy preliminary period for their extraction, paration, etc.

A. *Products which may be put to immediate use.* — 1) BREEDING STOCK eding stock are the most important of these products. Large companies ght be formed for the improvement and working of the immense pasture-ds of the northern and western basin of the Orinoco in conjunction with e Venezuelan land-owners, who would willingly support such undertak-s.

The Venezuelan cattle were imported from Andalusia by the Spanish nquerors. Breeding became important only after the War of Independence; was started in 1823 with about 260 000 head of cattle. This is but a ry small number, but it has increased greatly since then.

The breed, which in many ways, resembles the Portuguese " brava " ed, has never been modified by crossing : Its characteristics are : — ght, 3 $^1/_2$ to 4 $^1/_4$ feet, length from 4 to 5 feet. head, medium ; coat, usually ht (in bulls, darker, nearly mahogany); horns, medium, not very strong and ther short ; ribs, well-sprung ; back, slightly hollow towards loins ; weight, rying according to pasture (average weight from 913 to 924 lbs.). ¶

The Caracas abattoirs are very well fitted up. The dressed weight has ver been less than 50 % of the gross weight and may be as much as 55 %, even 58 % in the case of the heaviest animals (1 100 lbs.)

There are no diseases of cattle in Venezuela, the reports of an epidemic sease are false, and were doubtless spread by foreign agents who feared mpetition with the large breeding companies they were attempting to tablish.

The horses were also introduced into the country by the Spaniards. At the present day they number more than a million ; this takes into consideration the official figures of 1894, which gave 220 000 horses and 500 000 asses and mules.

The characteristics of the horses are : — head usually rather long, often slightly arched ; ears straight, medium ; neck average length, straight ; back sightly hollow ; sides a little slanting ; thighs fairly prominent ; sides rather flat ; stands ; fairly square ; hind legs set slightly in under body ; height from 11-3 to 14-2 hands ; coat usually chestnut, light or dark bay and sometimes, dappled roan. The horses are quiet and courageous ; they can carry an average weight of from 210 to 220 lbs., and, in harness can draw about 550 lbs. ; they can cover an average distance of 22 miles.

The characteristics of the mule are : — head, rather big ; profile slightly convex ; ears long, slender, and straight; length, between that of the horse and the ass, neck usually short and straight ; back slightly hollow ; vertebral line rather prominent, sides, straight ; limbs slender ; stands straight ; height from 12-1 to 13-3 hands ; the most common coats are mahogany bay and bright bay; greyish bay and dappled roan are also found.

The mules are very strong and very quiet, and, when mounted, cover an average distance of 37 miles a day.

2) FIBRE PLANTS. — The Cumana and Barquisito districts, the Andes and the Orinoco Delta supply a large variety of fibre plants belonging to the agaves, Urticaceae, Bromeliaceae and palms. Immediate use of the fibre would give profitable results.

3) OIL YIELDING PLANTS. — There are many varieties of palms in the Orinoco Delta which might be used in the oil industry. Of these the cocorzos are by far the most important ; the kernels yield a high-quality oil ; 10 tons of nuts give 1 ton of oil, which before the war, was valued at £32.

4) PETROLEUM. — There are petroleum wells in many of the coast districts, and, near them, great reserves of asphalt and bitumen.

5) PLANTS YIELDING TANNIN AND DYES. — These could be put to use immedately and the raw products sent to Europe.

6) FERTILISERS : — The principal fertilisers are : 1) guano, in the south of Barquisimeto, San Juan de la Morros, and of Cumana ; 2) phosphates in the islands of Avez and Roques, 3) saltpetre, in Bermuda, 4) magnesite in Margarita Island. Copper sulphate is also found in the pure state in the Villa de Cura district.

B. — *Products requiring preliminary preparation.* — The principal products which require the use of special machinery for their extraction and special transport are iron-ore, copper-ore, lead-ore and silver-ore for export, coal, gypsum, and alumina for home use. Opals, etc., have been found in the alumina districts.

There are great opportunities for the cultivation of gums, especially the rubber of *Hevea brasiliensis*.

FOREIGN INFLUENCE. — There are, in Venezuela, 3 principal districts in which foreign influence predominates : — 1) the eastern district, under French influence, the Sucre peninsula up to Cumana) ; 2) the central district

nder English influence, (from Guanta to Zucacas and even Barquisimeto) ; the western district, under German influence.

Although it does not predominate particularly, the North American influence is felt commercially over almost the whole of the country.

Different measures are taken by financial agents, such as the firm of BLUM of Caracas, to assure the harvest and cultivation of the land. The most common of these are loans for which the securities are the standing crops, or even the land itself. On the one hand there is a real and urgent need of funds, on the other, pressure by the agent. The security is fixed according to the average of many years ; once fixed, the value decreases by 3, 4 or 5 *bolivares*, and even more, per unit (sack of coffee, cocoa, etc.) put on the market. The money is lent at 1 %, 1.5 %, and sometimes 2 % per month. Only a year of exceptional harvest can free the borrower.

POLITICAL POSITION OF VENEZUELA CONSIDERED FROM THE POINT OF THE GEOGRAPHICAL POSITION AND FUTURE OF THE COUNTRY. — Venezuela is at the entrance of the Panama Canal, and is the South American State nearest to Europe. The opening of the Panama Canal assures it a new outlet for its natural products. It will be able to supply the boats using this route with both food and fuel. Though not so near to the canal as Colombia, it has superior means of communication connecting its ports with the interior. It is, therefore, in an extremely favourable position.

Everything still remains to be done in this country. From an agricultural point of view alone, it is pre-eminently a country of the future. It should be noted, moreover, that, up to the present, it has made no loan and has but a low debt which is regularly amortized each year, and which is comparatively insignificant in comparison with its ever increasing general commerce.

700 - **Agriculture in Queensland in 1915-1916.** — *Annual Report of the Department of Agriculture and Stock for the Year* 1915-1916, pp. 1-158. Brisbane, 1916.

The total area of land under cultivation during 1915 was 1 059 401 acres, an excess of 78 183 acres over the preceding year, an increase that was to a great extent due to the encouragement given in 1915 by the Government to add to the land under wheat, so as to make, as far as possible, Queensland self supporting. The drought, however upset these aspirations and all the main crops showed a decrease in acreage and in production, excepting bananas, which rose from 7796 acres to 8166 acres ; pine apples from 3423 to 3709 acres ; and apples from 2020 acres to 2179 acres. The produce per acre from the bananas and pineapples, too, was greater upon an average than for the preceding year, bananas producing 148 bunches to the acre, as against 136 bunches and pineapples 248 dozen as against 240 dozens.

All the grain crops, excepting rye and rice, showed much reduced average yields, but the value of farm crops did not, owing to the higher rates ruling in the markets, show such comparative falling off.

The number of holdings that may be classed as farmsteads was 24 828, an increase of 375 or 1.11 per cent. on the preceding year, and an increase of 5 889 over 1906, and an increase of 39.06 per cent in relation to 1904.

The total number of persons engaged in farming and in dairying was 58 840 and of these 1331 males and 1438 females were engaged in dairying. The total use of machinery and implements required for use in agriculture and dairying was £ 1 856 192. The total number of holdings upon which land was cultivated was 22 095, of which there were 2380 cultivating under 5 acres, 6488 owners of between 5 and under 20 acres, 6718 from 20 acres up to 50 acres and 6409 owners of 50 acres and upwards, the total acreage under cultivation being 1 059 401 acres.

Dairying. — The figures of the Government Statistician show that the total milk in 1915 was less than the preceding year by 30 per cent, the figures respectively being 70 093 674 gallons and 100 189 876 gallons. The output of butter was reduced by 32 per cent, of cheese by 45.45 per cent, the number of butter factories in operation being increased by one and of cheese factories by seven. In 1914 there were 387 311 cows and in 1915 the number was reduced by over 52 000 on account of the drought, the reduction in the quantity of butter being equal to about 5211 tons.

Live Stock. — The reduction in live-stock during 1915 was less than in the drought year of 1902 excepting with regard to sheep, as will be seen from the following comparative figures:

	% of Reduction 1902	% of Reduction 1915
Horses	13.63	7.56
Cattle	32.58	12.37
Sheep	28.08	31.04
Swine	36.53	29.03

There were on the 31st. December 1915, 686 871 horses, 4 780 893 head of cattle, 15 950 154 sheep and 117 787 pigs in the State, the reduction in each case being of horses 56 188, of cattle 675 050, of sheep 7 170 715 and of pigs 48 851. It is interesting to note that the number of owners of 100 head and under increased by 728 persons and that the total number of owners of cattle increased by 335 persons, notwithstanding the decrease in the stock as a whole. The average number of cattle held by 40 051 persons was 119 head. Of the total number of sheep there were 4091 owners and the average number of the flock was 3899.

With regard to sheep, however, is is hardly fair to take an average of the whole number, from the point of view of the number engaged in the industry. For instance, there were 2447 persons who owned a thousand head, or less, and 175 persons who held from 20 000 upwards, the latter class owing 7 585 655 sheep, or about one-half of the whole number.

An idea of the progress of sheep farming by the smaller holder is to be found in the holders of under 500 head, of whom there were 2013 against 1492 people in 1914.

The percentage of lambing was 29.60 per cent in 1915 as against 54.19 per cent. in 1914, the number of lambs dropped in 1915 being 2 146 471.

There were, in 1915, 117 787 head of swine in the State, while the export

d home consumption requirements are 216 253 head. This position was t caused by the drought, but is experienced very year.

Meat Trade. — There were 23 establishments for meat preserving or bacon curing in operation during the year, and these employed 5050 per-is, the value of the machinery and plant being £ 944 059, land and mises to the value of £ 893 094, and the output was worth £ 6 478 833, decline of between 8 per cent. and 9 per cent. on 1914.

Wool. — The wool market during 1915-1916 totalled in Brisbane 246 376 es, against 182 376 bales for the year to 30th June, 1915. Excepting 0 bales of New South Wales wool, the whole was of Queensland growth, l was made up of 97.5 per cent of merino wool and 2.5 % of cross-bred l all strong wool.

Reduced to pounds, the sales consisted of 61 283 049 lb. of greasy wool n average value of 11.1 d. per lb. and 15 285 896 lb. of clean wool of a ue of 22.5d. a lb. or a total value of £ 4 279 498.

Sugar. — The sugar season of 1915 resulted in a shortage of approxima-100 000 tons due to the severe drought experienced in nearly all the ar districts of Queensland. The total acreage under cane in 1915 was mated to be 153 027 acres, a decrease of 8168 acres compared with the vious year. Of this cane from only 94 459 acres was crushed. This lted in a yield of cane of 1 152 516 tons, or an average of 12.2 tons per ; an abnormally low figure. The amount of cane used by the mills to nufacture one ton of sugar was 8.2 tons, a lower figure than at any time tofore.

The work of the Bureau of Sugar Experiment Stations has been con-ed in the direction of the introduction of successful varieties of cane from er countries. The analytical and commercial testing of the varieties ed by the Queensland Acclimatisation Society, and presented by the ar Bureau has now been completed, and many of these new canes are g distributed free to cane growers.

The Relation of Farm Weeds to Hay Fever. — HALL, H. M. in the *Monthly Bulletin State Commission of Horticulture*, Vol. VI, No. 2, pp. 44-47. Sacramento, California February, 1917.

It is estimated that each year more than 100 000 people in the United es suffer from hay fever. Anemophilous plants, being the richest in en, are the most liable to cause the fever. In determining the agent "biological test" is used, that is to say, a small quantity of the suspect-ollen is placed on the nostrils or the corner of the eye of a person suscept-to hay fever, the symptoms of which develop in positive cases. Epi-nic reactions with pollen solutions are also used. Immunity may be ined by the injection from time to time of a vaccine prepared from kind of pollen to which the patient is susceptible. This immunising tment is still in the experimental stage.

The causes of this illness have been thoroughly studied by the Ameri-Hay Fever Prevention Association, the plants causing it have been mined, their injurious effects made known to the public and the ression attempted by means of both cooperation and legislation. These

methods have greatly reduced the number of cases in certain districts, notably in New Orleans.

Plants causing hay fever have also been studied in California. With the co-operation of the Faculty of Botany of the State University, of botanists and doctors, the above-mentioned Association has collected and examined the pollen of many suspected varieties. The results obtained so far show that the greater part of the forage Gramineæ cause spring hay fever. Johnson grass (*Sorghum halepense*), ray grass (*Lolium italicum*), and a mixture of timothy grass and *Agrostis vulgaris* all give a positive reaction to the biological test. The poller of the Gramineæ is, however, usually less harmful than that of other families, particularly the Compositæ. The following plants, other than Gramineæ, have so far been found to cause hay fever; they are given in decreasing order of perniciousness.

Western Mugwort (*Artemisia heterophylla*), Western Ragweed (*Ambrosia psilostachya*), Cocklebur (*Xanthium pennsylvanicum*), False Ragweed (*Franseria acanthicarpa*, *Franseria tenuifolia*), Curly Dock (*Rumex crispus*), Pigweed (*Chenopodium album*), Wormseed (*Chenopodium anthelmicum*) (the last 3 only give a weak reaction), *Atriplex* sp. (*Atriplex bacteosa* gave a marked reaction with one patient).

The following plants are strongly suspected:

Sand-bur (*Franseria dumosa*), Poverty Weed or Western Elder (*Iva ascillaris*), Burro (*Artemisia spinescens*), Russian Thistle (*Salsola Kali*), Hymenoclea (*Hymenoclea Salsola*), Guatemate or Mule Fat (*Baccharis viminea*), Spiny Clotbur (*Xanthium spinosum*), Sneezeweed (*Helenium puberulum*), Iveline Brush or Kern Greasewood (*Spirostachys occidentalis*), Burro Sage (*Grayia spinosa*).

702 - Agricultural Experimentation in the Argentine Republic. — *Ministerio de Agricultura de la Nación, Dirección General de Enseñanza y Investigaciones Agrícolas*, No. 1; 1-572. Buenos-Ayres, 1915.

The Director of Agricultural Education and Experiments (Ministry for Agriculture of Argentine) has published this monograph on agricultural experimentation, including, besides an historical part, an account of the present state and organisation under existing rules, together with an account of all the plans for experiments to be carried out at each of the agronomic and experiment stations.

The task given to the Sections of the Agronomic and Experiment Stations (which depend on the Ministry of Agriculture) is: to acclimatise, select and produce varieties suitable for agricultural purposes; to study the cultural conditions most suitable for the different regions; to determine the exact quantity of water necessary for irrigation and according to the various cultural systems; to consider the possibility of industrialising certain agricultural products; and to compare, to this end, the different methods and propose the most suitable ones.

For this purpose, the Section has an œnological station at Concordia, 5 agronomic stations of a scientific character in the different zones of the country, that is: Alto de Sierra (Andes zone), Güemes (subtropical zone), Pergamino (central zone), Guatraché (La Pampa zone), Rio Negro (southern zone of irrigated valleys); new experiment stations for demonstra-

n purposes, established in places well chosen from the geographical point view (Loreto, Colonia Benitez, Bella Vista, Catamarca, la Roija, La Banda, ndara, Tigre, 25 de Mayo) and 5 experiment substations for cereals, highly scientific character, divided in the cereal zone (San Jorge, Pon- nt, Guatraché, Bengolea and 25 de Mayo.

Each agronomical station and experimental station, according to y, receives an annual subsidy of 612 000 pesos and 6000 pesos respectively.

The programme of work includes 234 projects for experiments, for h of which are indicated: the place of the experiment, the aim, the nner of procedure and the approximate cost.

CROPS AND CULTIVATION.

Influence of Temperature and Moisture on the Growth of Millet (1). — BIELOV, C. A., in *Труды Бюро по Прикладной Ботанике* (*Bulletin of Applied Botany*), Year 9, No. 7, (92), pp. 333-351, fig. 9. Petrograd, 1916. AGRICU METEOI

In the *Panicoideae* group, the second flower of the spikelet usually has ther andraecium and nor gynaecium; it is only in exceptional cases that is of normal formation, capable of being fertilised and of forming seed. the district in which is situated the Besencink agricultural experiment tion (South-Eastern Russia), after an unusually wet year, such as that 1913, the phenomenon of two grains per spikelet is more frequent, thus ducing an increased yield. In very dry districts production increases proportion to the length of the growing period, which is in direct ratio to total precipitation.

This phenomenon is shown in the following table, which gives the re- ts of a series of pot experiments.

BLE I. — *Duration of the period of growth of millet at varying degress of soil moisture (pot experiments, 1914).*

Soil moisture	20 %	40 %	60 %	80 %
...um miliaceum L. var. *compactum* (red).	88 days	95 days	106 days	106 days
» » » (white).	91 »	95 »	106 »	106 »

In proportion as drought increases and the period of growth dimin- s the number of seeds formed and developed also diminishes progres- ly, the more so as the average size of the seeds is greater. Therefore, en selecting a variety of millet (*Panicum miliaceum* L.) well adapted to arid climates, preference should be given to small-grained types. A es of parallel meteorological and biological observations was undertaken

(1) See *B.* March, 1917, No. 221.

to demonstrate and study the nature of the close relationship betwe flowering and weather. The results showed that: 1) during very damp an misty days the flowering glumes do not open at all; 2) if there is a high te perature, little moisture and a clear sky, flowering begins at 8 a. m., and m even be advanced by an hour by concentrating the sun's rays on to the clos flower by means of a magnifying glass. This procedure loses its effica as the day advances and gives completely negative results after 11 o'clock The maximum flowering energy (separation of the glumes and appearan of the stamens) occurs between 10 and 11 o'clock, and is considerably re duced after midday.

In the Samara district there is such a close and well-marked meteo ological and physiological relationship that it is possible, by studying th manner and rate of flowering, to form a fairly exact idea of the course of th thermal and hygroscopic values.

704 - **Factors Affecting the Evaporation of Moisture from the Soil.** — HARRIS, F. S. and ROBINSON, J. S. (Utah Agricultural Experiment Station), in the *Journal of Agricultu Research*, Vol. VII, No. 10, pp. 441-461 + fig. 1-17. Washington, D. C., 1916.

Soil moisture, which is of great importance in agriculture, may, in arid districts, be lost either by capillary attraction, which draws the water to the surface, or by evaporation, which is one of the most important factor in preserving the moisture of the soil. This paper gives, first a critica review of the scientific literature on this subject, then a description of a series of experiments undertaken from 1912 to 1916 in different soils an under varying conditions.

The results show that the evaporation of the water of the soil is in di rect connection with the original moisture; the differences are slighter whe there is much moisture than when there is little, and there appear to b critical points at which evaporation undergoes sharp variations. Evaporation in moist soil diminishes very rapidly in proportion as the moisture in th air increases. Air currents cause an increase in evaporation, which, however becomes very slight beyond a certain velocity. In completely saturate soils evaporation is greater when the soil particles are fine than when the are coarse. Decrease in sunshine causes a great decrease in evaporation which is also affected by sudden variations in temperature, however slight they may be. Evaporation is effectually restricted by a thin, dry mulch but more so when the particles are coarse than when they are fine. Compact ing the surface increases evaporation. Finally, evaporation may b reduced by the addition of a concentrated solution of soluble salts.

A bibliography of 41 publications is appended.

705 - **The Effect of Soil Moisture Content on Certain Factors in Wheat Production.** - HARRIS, F. S. and MAUGHAN, H. T., in *Utah Agricultural College Experiment Station Bulletin* No. 152, pp. 1-15 + figs. 1-15. Logan, Utah, February 1917.

A knowledge of the intimate relations between the crop and the moistur of the soil is important to every farmer, particularly to those in arid di tricts. For this reason the authors carried out experiments to determin the water requirements of wheat and the water content of the soil durin various stages in the growth of the crop.

The experiments were carried out during the years 1913, 1914, and 1915 36 galvanised iron tanks, each of which contained 476 pounds of water- e loam with a high lime content. Spring wheat was sown and evapora- on prevented first by a ½-inch sand mulch, and later with paraffined per; any loss was made up with very pure tap water. The tanks were vided into 18 series of 2 tanks each, the series having varying moisture nditions. The life of the plant was divided into 3 periods: 1) from plant- g until there were 5 leaves; 2) from the 5-leaf stage to full earing; 3) from ll earing to maturity.

The results showed that the highest yield of grain was obtained when the e soil contained about 20 % moisture throughout the season. This was out ⅓ of the moisture required to saturate the soil completely. Wheat as particularly sensitive to soil moisture during the period immediately ceeding earing.

There was a greater loss of moisture by evaporation and transpiration m soil producing a large crop than from a free water surface, but the loss s greater from the water surface than from a soil producing only a small p.

Under favourable moisture conditions the crop was 20 times as great under unfavourable ons. Wheat may suffer as much from excessive isture as from excessive dryness; the importance of favourable soil isture conditions is, therefore, clear.

- Rainfall, Irrigation and Subsoil Water in the United Provinces of Agra and Oudh. — Molony, E. A., in *The Agricultural Journal of India*, Vol. XII, Part I. pp. 85-89. Calcutta, January 1917.

The writer has examined the rainfall and irrigation statistics in the ited Provinces and shows that in the last 29 years the increase in well igation is 52 per cent. the increase in canal irrigation 72 per cent., while e decrease in tank irrigation amounts to 29 per cent. The writer is of e opinion that these differences are too great to be explained entirely by nfall.

In the United Provinces nearly 58 per cent of the total irrigation is ne from wells. This fact, coupled with the very general complaint heard late years that the water level in the subsoil shows a serious fall, indi- tes the desirability of examining the underground water supply in order ascertain if it can stand permanently the existing strain on it, particu- ly because of the much greater drain caused by construction of many w wells and improved methods of lifting the water.

Examination of statistics for the last 20 years shows that there has en imposed on the subsoil water supply an additional drain amounting the water used for the annual irrigation of 2 million acres. From this d judging from the areas irrigated by canals and tanks in addition to lls, it seems clear, leaving out of account variations in the rainfall, that e annual net addition to the subsoil water supply is less than it was 20 ars ago. If well irrigation continues to extend, it seems clear that the l in the subsoil water must continue. In years of good rainfall the l will be arrested, giving a temporary relief only.

As possible remedies or at least palliatives, for the stopping the fa in the subsoil water level, the writer suggests that :

1) the great fall in the area irrigated from tanks is due to the polic of surface-drainage, which has probably been carried too far ;

2) at times when the irrigation water was not all used, the surpl water should go to fill the tanks and not run to waste. Irrigation done fro tanks thus filled might be charged at a lower rate as an inducement to sa the waste ;

3) attempts might be made to increase the supply of water to th subsoil by excavating wells in the beds of tanks or streams so as to make direct communication between the surface and subsoil water. It is possibl that drainage into the subsoil would be found to possess nearly all the ad vantages of surface drainage without its great drawbacks ;

4) keeping all the land under the plough is the most efficacious re medy, but the cost would be immense ;

5) in undulating country much water might be saved by extendin the practice of constructing field or ravine embankments.

707 - **The Drainage of Irrigated Shale Land.** — MILLER, D. G. and JESSUP, L. T., in *Unit States Department of Agriculture, Bulletin* No. 502, pp. 40, fig. 12 + IX plates. Washington D. C., April 23, 1917.

Drainage is one of the most important problems to be solved by far mers of irrigated lands, especially those consisting largely of shale whic may or may not outcrop, and in which the soil is made up largely of dis integrated shale. Such soils are found in all the Rocky Mountain States and it is with them that this bulletin is concerned. The geological feature surface topography, and underground water systems in their relation to the different types of shale of the district, are first described. This is follow ed by a study of the most suitable drainage methods to be employed.

The main conclusions may be summarised as follows :

Shale is an important factor in the movement of underground wate especially in those areas where uplifts and displacements have occurred.

Shale may influence the movement of seepage water in 3 differen ways ; it may pass : 1) over the top of the undisturbed and impervious strata 2) between the layers ; 3) through joints, faults and cleavage planes.

The minor features of the surface of the underlying shale are frequently quite irregular and are masked by the overlying soil. They can only b determined by soil borings.

The source of the seepage water is deep percolation, resulting fro irrigation and from seepage losses from canals and laterals.

Artesian conditions exist usually where the seepage water move through the shale, although the pressure may be low owing to a large num ber of areas of leakage in the confining medium.

There is a relation between the seepage areas and the topography o the underlying shale. The affected areas usually occur near shale ridge and points. This is because there is a greater porosity in the shale ridge than in the deeper zones, as the ridges, having sustained the effects o weathering, are more shattered and fractured, while the points are mor

pen and greater in number. Moreover, the soil covering is shallowest ver the ridges.

The deeper zones carry most of the water owing to continuity and reater area of cross section, and the general movement of the water is rallel with the main jointing systems of the shale.

Practically all shales are rich in alkali and the seepage waters leach out rge quantities. Consequently many of the waters discharged from drai- ge systems in shale have a salt content as high as 2 and 3 %, in which e many nitrates. Because of this condition of the seepage water the ater-logged soils of shale lands rapidly develop a severe alkali problem.

Shale lands cannot be drained by the ordinary methods because of e movement of the water through the shale under pressure and also be- use of the extreme retentiveness of the overlying adobe soil.

The 3 essential factors for the successful drainage of shale lands are: proper location of drains; 2) sufficient depth; 3) relief wells.

Drains must be located so as to tap the contributing shale features, ch as ridges, points, knolls, etc. This necessitates careful and complete eliminary examination.

The amount of shale reached and the amount of water developed are gmented by increasing the depth of the drains. These depths should ver be less than 6 feet, and generally depths of 7 and 6 feet and more e essential to success.

A system of drainage in many of the shales will be incomplete and un- ccessful without relief wells.

These relief wells are simply artesian wells. This does not necessarily ean that the water rises to the surface and overflows, since any well many e considered as artesian where the water rises to some extent after having en drilled through a comparatively impervious stratum into one carrying ater; in other words, where the water enters the well under pressure.

Seepage areas occur almost invariably where pressure conditions exist nd the movement of the water is upward. In a few cases only is it possible place the drains deep enough to reach the supply of water that causes e saturation. Often the water-carrying zones of shale have been found depths of 30 feet. The cost of installing drainage lines becomes prohi- itive long before this depth is attained, but unless the water-carrying elium is reached drains will be of little service however carefully they may e located and constructed, or however closely they may be spaced. There re cases in which drainage systems have been constructed in shale to a epth of 7 feet and developed considerable quantities of water, and yet eepage water rises to the surface.

Flowing springs have been found within 10 feet of a 7 foot trench. These esults show clearly that ordinary methods of drainage will not relieve eepage conditions where the water is supplied under pressure.

The purpose of the relief well is to connect the tile line with the deeper trata which are the sources of the seepage water and to relieve the pres- ure by allowing the water to pass out freely. As the area of influence of elief wells is small they should be closely spaced, in many cases 5 or 6 to

100 feet of trench. The depth of the wells should be from 6 to 20 feet low the bottom of the tile drain. The greater part of the water develo by most of the drainage systems in shale comes from the relief w A diameter of 2 inches is sufficient for the relief wells, and in most of shales they have been installed with a soil auger. Frequently, howe hard strata require the use of a churn drill.

The cost of labour for trenches in shale ranging from 6 to 7 feet depth is $ 0.25 per hour. The unit costs of excavating, laying tile and ba filling, together with the cost of installing the relief wells, range fr $ 0.12 to $ 0.25 per linear foot of trench. This does not include the c of material for the drains.

The cost of drainage of the lands referred to in this bulletin ranged fr $ 13 to $ 100 per acre.

Once seepage trouble has developed in shale lands it increases rapi The quantity of the alkali salts at or near the surface also increases rap in water-logged lands of this type. The drainage problem and that of moving excessive salts are simplest, the construction most economi and the results most satisfactory therefore if the drains are installed at first sign of the trouble.

708 - **Spray Irrigation.** — WILLIAMS, MILO B., in the *United States Department of Agri Bulletin* No. 405, pp. 40, figs. 19. Washington, D. C., February 14, 1917.

During the last 10 years spray-irrigation (1) has spread greatly thro the United States, particularly in the Atlantic Coast from Massachus to Florida. It is particularly well adapted to supplement uncertain r fall in market gardens and orchards. The economic conditions must, h ever, be favourable, as the cost of installing this system is relatively hi While a portable outfit may cost only $ 50 per acre, a stationary dist ution system may cost as much as $ 150 per acre, not including the c of a pumping plant and the laying down of a main pipe line to the fi

The cost of installing a stationary plant for a small acreage amo to $ 250 per acre, and the annual incidental expenses come to $ 51 per a The high cost prohibits the use of this method for many crops, but i is combined with ordinary irrigation methods the expenses are less he Spray irrigation is practically independent of the topography of the f and can be applied to land too rolling or rough for surface methods.

As spray irrigation is comparatively recent, the author carried various tests to determine the amount of water required by this system

In damp climates amounts not exceeding ½ inch are considered su ient for seed beds and young vegetables, whereas maturing garden crops strawberries require ½ to 1 inch. In the growing season markets gar need from 4 to 6 inches. The Florida citrus groves may require as muc 3 inches per irrigation.

In arid districts market gardeners irrigate every 3 or 4 days, whil trus growers apply from 4 to inches each time. As a rule, in damp dist

(1) See *B.* 1912, Nos. 486 and 627; *B.* 1914, No. 1090; *B.* 1915, Nos. 15 and 1370.

epth of 1 inch per week suffices, but in arid districts 1 ½ inches per week required. Information is given on the installation of pumps, and the king of sumps, shallow wells and deep wells.

Three types of spray irrigation have been generally adopted :

1) Hose and movable nozzle or movable lines fed from an underound pipe system and hydrant ;

2) Circular nozzles fed from an underground pipe system ;

3) Overhead spray lines fed from an underground main feed pipe.

The hose and movable nozzle type has long been in use, chiefly for tering parks and flower beds, and also in some Florida citrus groves. A dification of this system is the use of a ¾ inch pipe, 18 to 20 feet long, taining a row of small nozzles similar to those used in overhead irrigation tems. This pipe, connected to the water supply by a hose, is supported movable or stationary tripods.

Stationary nozzles fed by underground pressure systems of piping are ich in favour in Florida for market gardens or citrus groves where the dy character of the soil demands rapid irrigation. The water is driven by pressure through an underground steel or wrought-iron pipe, but the in feed pipe is sometimes in cast iron or riveted steel. Laterals are placed to 15 inches below the surface in parallel lines. At intervals of 30 to feet risers are placed on the laterals, at a height of 4 to 6 feet above the face for market gardens, and at a height above the trees in orchards.

The risers are placed alternately in lines as is shown in figure 1. Each ral is controlled by a valve, and, in some cases, the risers too are fitted h valves, so that the water may be cut off as necessary.

Spray irrigation system.

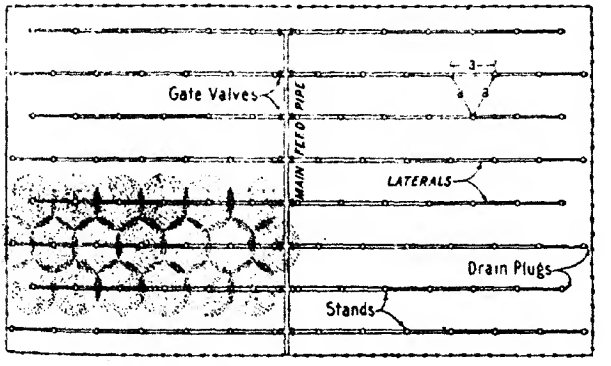

Fig. 1. — Plan for piping a field for stationary-nozzle spray systems, showing the positions ozzles.

Figure 2 shows the fittings for the stationary-nozzle spray system.

The nozzles vary in design, but may be divided into 3 groups : 1) solid nozzles with no movable parts; 2) adjustable nozzles with parts which can be manipulated to change their capacity or form of spray; 3) rotatory nozzles. A series of experiments carried out in 1909 on the efficiency of various nozzles, showed that, in every case, the distribution of the water is very uneven. The solid and adjustable types placed the maximum amount within a radius of about $^3/_4$ that of the sprayed area.

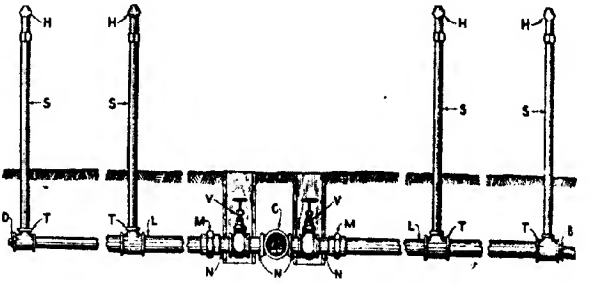

Fig. 2. — Sketch showing typical fittings of underground laterals for stationary nozzle spray systems :

A, Main feed pipe ; B, bushing at reduction of pipe sizes ; C, cross in main feed pipe ; D, drain cock or plug ; H, nozzles ; L, lateral pipe lines ; M, malleable unions ; N, nipples ; S, 1 inch galvanised stand pipes ; T, malleable tees ; V, brass gate valves.

The rotatory nozzles distribute the greatest amount of water near the centre, and the amount received decreases with the distance from the nozzle. The cost of this system exceeds that of the hose and portable nozzle, and, in many cases, that of overhead equipment. The cost of working is about the same as that of the overhead system, but it is usually less efficient than this latter method ; one of the drawbacks to this system is that it distributes the water unevenly.

The stationary overhead spray system marks a great forward step in spray irrigation, for commercial crops. Originally this system consisted of a few lengths of steel pipe set on parallel rows of posts and connected with a hand force pump. A series of small holes were drilled in the pipe through which water could be forced in the form of spray. In order to remedy the clogging of the holes, they were replaced by small brass nozzles, screwed into the pipe. So that a piece of land 50 ft. wide could be irrigated all over, the nozzles were placed on pipe lines that could be turned or rolled in bearings. Figure 3 shows the underground system of the main pipe and the arrangement of the overhead pipe lines. The main pipe should be made to run as straight as possible ; the nozzle lines should run perpendicular to the main pipe.

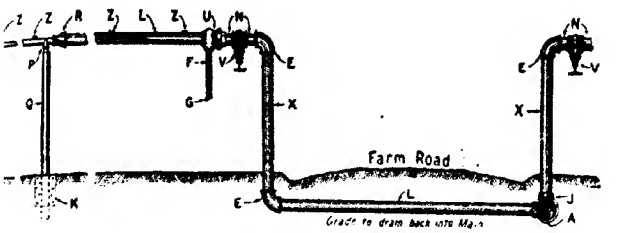

Fig. 3. — Typical fittings for overhead nozzle lines connected to main feed pipe and method crossing a farm road.

A, Main feed pipe; D, drain cock or cap; E, elbow; F, handle for turning nozzle lines; , cap on handle; J, side-outlet tee; K, concrete base for pipe post; L, nozzle line pipe; , "long" nipples; P, pipe-hanger; Q, 1 ¼ inch pipe post; R, reducing cocket; U, turning ion; V, brass gate valve; X, risers to nozzle lines; Z, nozzles.

The size of the overhead pipes is dependent on their length, and should ot exceed 1 ½ inches. The end connecting with the feed pipe must be fficiently large to carry the full head of water. As the water is diminished y each nozzle, the pipe can be reduced in size, finishing with a ⅜ inch pipe t the extreme end. The lines are 50 to 56 feet apart; this allows the wa- r to be sprayed over the whole field. The pipes are placed either on posts r on cables suspended from high posts. This last method allows the pass- ge of horses and unobstructed working all over the field. If wooden posts e used they should not be lighter than 4 by 5 inches, and should be set the ground at a distance of 2 to 2 ½ feet apart. The posts may be either igh or low, according to the nature of the crop. Posts for cables should e 100 to 200 ft. apart, and the nozzle line is suspended from a tight cable r wire strand. Telephone posts, 8 to 10 inches at the base and 6 to 8 in- hes at the top, are very suitable. Both the end posts and the cables must be rmly anchored in the soil. The chief difficulty lies in the cleaning of the ozzles; for this reason the pipe should be kept within reach.

The overhead pipes are usually of galvanised wrought iron or steel; he main underground pipe of steel or wrought iron with threaded joints. ast iron pipes last longest, and are comparatively cheap. The various ypes of pump are described, and details for the installation of spray irri- tion systems are given.

09- **Rotations and Tillage Methods in Western Nebraska.** — SNYDER, W. P. and OSBORN, W. M., in *The University of Nebraska Agricultural Experiment Station Bulletin* No. 155, pp. 1-48. Lincoln, Neb. June 1, 1916.

The data reported in this bulletin are the results of experiments in otations and tillage methods conducted on a series of one-tenth acre plats n the table-land of the North Platte Experimental Sub-Station during he past eight years. This bulletin is a means of reporting progress, or esults thus far secured, rather than a report of conclusions drawn from a inished line of investigation. These results are presented in 13 Tables and 1 Charts including records of precipitation by months, the weather con-

ditions of the season during which the crop is grown being the greate factor controlling yields in Western Nebraska.

The conclusions reached so far are the following:

The seasonal precipitation has a much greater influence on crop pro duction than methods of seed-bed preparation, crop sequence or manur

During favourable seasons profitable crops have been produced by al methods, and during unfavourable reasons profitable crops have not bee produced by any methods.

The system of alternate cropping and summer tillage has failed t overcome severe drought conditions and has been less profitable in the pro duction of corn and spring grain than ordinary methods of productio (winter wheat is not considered in this report). However, the system of alternate cropping and summer tillage, during some unfavourable years has given a large increase in yields over common practices and thus has served as a practical insurance against entire crop failure.

From the standpoint of either yields or profits it matters but little whether the land is fall plowed or spring plowed for spring grain or corn

The spring grain planted on corn-stalk land has not yielded more than when planted on spring-grain stubble, it has given more profit when grown on the corn land on account of there being less labour required in preparation for seeding on corn land. Farmyard manure has not increased the yield sufficiently to pay for the application of the manure, probably because water rather than plant food is the factor controlling production under these conditions. However, it is believed that the use of manure is advisable as a security against a deficiency in fertility and humus.

Green-manure crops are too expensive for practical use under present conditions.

If a value of $ 4 per ton is given to sorghum hay this crop becomes one of the most profitable crops here considered. During favourable seasons and also under drought conditions it has given a larger tonnage than any other crop,

As a single crop, corn ranks above any of the spring small-grain crops in profit returned where the stover and grain are both used. Corn following corn has yielded 5 bushels more per acre than corn following small grain. Spring wheat ranks next to corn in profit returned in these rotations. It gives the greatest profit where it follows corn.

Oats have proved the least profitable of the crops grown, and have usually been grown at a loss.

Neither alfalfa nor brome grass has been grown successfully in these rotations. The failure of these crops should be expected when grown on high table-land of this character, unless seeded in rows and cultivated. Among the many rotations there was none in which the crops were grown according to common farm tillage practice conducted in a thorough manner that did not give an average annual net profit of more than $ 1 per acre. The results of this work to date commend the common tillage practices of the farmers throughout this region in so far as these practices are conducted in a thorough and intelligent manner.

0 - **The Plant Food Materials in the Leaves of Forest Trees.** — SHREK, P. JR., in *The Journal of the American Chemical Society*, Vol. 39, No. 6, pp. 1286-1296. Boston, Pa., June 1917.

The investigations described were undertaken to determine the plant od constituents of the leaves of three typical New England forest trees *astanea dentata, Acer saccharum* and *Quercus alba*) at the beginning and d of their growth (spring and autumn), on branches at different heights m the ground, and in different soils, namely Suffield clay, Holyoke stony m and Triassic stony loam. The manurial value of the different leaves is also determined.

TABLE I. — *Results obtained for the chestnut.*

Season	Soil	Height of branches (feet)	Dry matter: Nitrogen per cent	P_2O_5 per cent	K_2O per cent	Manurial units	Estimated value per ton (dollars)	Estimated value per ton on a 20 % moisture basis (dollars)
	Suffield clay.	10	1.954	0.6992	1.489	7.07	5.65	4.52
	" . . .	50	1.930	0.6852	1.221	6.72	5.37	4.29
autumn	Holyoke stony loam .	10	2.438	1.162	0.9917	8.25	6.60	5.28
1913	" . .	50	2.106	0.9428	1.017	7.21	5.76	4.60
	Triassic stony loam .	8	1.798	1.533	1.460	9.66	7.72	6.17
	" . . .	50	2.991	1.405	1.343	10.20	8.16	6.52
spring	Holyoke stony loam .	10	2.959	1.024	1.450	9.87	7.89	6.31
1914	" . . .	50	2.660	0.933	1.747	9.34	7.47	5.97

The highest cash value for the chestnut is obtained from leaves taken m the top branches in autumn in Triassic stony loam.

TABLE II. — *Results obtained for the sugar maple.*

Season	Soil	Height of branches (feet)	Dry matter: Nitrogen per cent	P_2O_5 per cent	K_2O per cent	Manurial units	Estimated value per ton (dollars)	Estimated value per ton on a 20 % moisture basis (dollars)
	Suffield clay.	15	1.379	0.4948	0.8555	4.79	3.83	3.06
	" . .	45	1.446	0.6305	0.8837	5.11	4.09	3.27
autumn	Holyoke stony loam .	8	2.126	1.031	1.014	7.34	5.87	4.69
1913	" . .	50	2.110	1.125	1.193	7.59	6.07	4.85
	Triassic stony loam .	8	1.907	—	0.7249	—	—	—
	" . . .	50	1.420	1.056	1.007	5.61	4.48	3.58
spring	Holyoke stony loam .	8	3.201	0.9303	1.614	10.54	8.43	6.74
1914	" . . .	50	3.483	1.079	1.834	11.61	9.28	7.40

In the sugar maple the highest value is obtained from the leaves of highest branches in spring in Holyoke stony loam.

TABLE III. — *Results obtained for the oak.*

Season	Soil	Height of branches (feet)	Dry matter					Estimated value per ton on a 20% moisture basis (dollars)
			Nitrogen per cent	P_2O_5 per cent	K_2O per cent	Manurial units	Estimated value per ton (dollars)	
Autumn 1913	Suffield clay	12	2.079	0.5182	1.022	6.72	5.33	4.2
	"	40	2.097	0.6479	1.325	7.19	5.74	4.6
	Holyoke stony loam	5	2.475	0.9634	1.007	8.13	6.50	5.2
	"	50	2.453	1.091	0.9687	8.28	6.54	5.2
	Triassic stony loam	10	2.044	0.7295	1.282	7.01	5.60	4.4
	"	40	2.253	0.9389	1.280	7.84	6.27	5.0
Spring 1914	Holyoke stony loam	5	3.175	1.048	1.581	10.55	8.44	6.7
	"	50	3.460	0.9399	1.519	11.11	8.88	7.1

In the oak the highest value is obtained from the leaves of the top branches in spring in Holyoke stony loam.

CONCLUSIONS. — Leaves collected in spring have a higher nitrogen and potash content than those collected in autumn. The phosphoric acid content varies with the species of the tree and with the section of the tree from which the leaves were obtained. The lowest nitrogen and phosphoric acid content is found in leaves from trees grown upon a clay soil. The highest content of nitrogen, phosphoric acid and potash occurs in leaves from trees grown upon Holyoke stony loam and Triassic stony loam. In the majority of cases the leaves from the upper branches of the maple and oak have a higher content of nitrogen, phosphoric acid and potash than those taken from the lower branches, whereas, with a few exceptions, the reverse is true for the chestnut. The estimated theoretical cash value of a ton of leaves calculated upon a 20% moisture basis varies from $5.33 to $6.50, according to the kind of leaves and the portion of the tree upon which they are grown. The cost of collecting and handling would probably exceed the value of the leaves; it is, therefore, inadvisable for farmers to spend time in this way. Spring leaves usually have a higher value; at any rate, it is wisest to let the leaves remain where they fall as they contribute greatly to the growth of trees in woodlands. If the acidity of newly-fallen leaves is taken into consideration it is seen that it requires 25 tons of ground limestone to neutralize 250 tons of freshly-fallen leaves of the white oak tree. If the leaves are used in hot-beds, greenhouses, or on the field, it is therefore, advisable to compost them and allow them to decompose until they have reached the alkaline stage. The slight loss involved by this process through volatilization and leaching is compensated for by the favorable alkaline condition of the leaves and the large amount of alkali added to the soil.

1 - **The Chemical Composition of Basic Slag.** — JANSSENS, VAN RAAIJ, C. (Rijkslandbouwproefstation te Maastricht), *Verslagen van Landbouwkundigen Onderzoekingen der Rijkslandproefstations*, No. XX, pp. 26-33.

Since the beginning of the war two types of basic slag have been put n the Dutch market, one with a low content (7-8 %), the other with a gh content (15-19 %) of phosphoric acid. Comparative analyses of these d normal slags gave the following averages:

	Normal Slag — %	Low Standard Slag %	High Standard Slag %
Silica	6-7	13.5-17	5.8-14.1
Phosphoric acid	16-22	6.8-7.7	14.8-19.1
Alumina	0.9	2.1-2.8	1.02-4.0
Total iron as sesquioxide	11.8-17	28-32	11.3-17.6
Oxide of iron	6-10	—	6.7-8.5
Oxides of manganese	7-8	4.3-5	6.3-13.2
Free lime	1.5-5.5	6.2-7.8	1.7-5.2
Total lime as oxide	47-48	36.6-42.9	46-52.4
Magnesia	1.5-2	2.8-3.9	0.7-2.8

As is seen, the two types of slag show, in some cases, a high silica content, probably due to the addition, during manufacture, of fine sand for the purpose of increasing the solubility in citric acid. The content in alumina, magnesia and free lime is rather greater in high standard slag, which also contains much iron, both metallic and combined, whereas its percentage of lime and manganese is low.

The proportion of other components is usually normal in samples of high standard slags.

It is thus seen that the high standard slags now on the Dutch market are equal to the normal ones, and may be freely used in agriculture.

This is not the case with low standard slags, since their high iron content causes the formation of practically useless iron phosphates in the soil, thus ultimately decreasing the phosphoric acid content. Considering the high cost of transport the use of such slags is inadvisable in spite of the shortage of phosphatic fertilisers.

12 - **Estimation of the Cyanamide Nitrogen in Two Calcium Cyanamide and Lime Nitrogen.** — BERKAUT, A. D., HENDRICKSZ, R. D. and WIND, G. (Rijkslandbouwproefstation te Maastricht), in *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstation*, No. 20, pp. 43-51. The Hague, 1917.

From their experiments the authors conclude that the best methods of estimating cyanamide in calcium cyanamide are the two following:

In both cases 2 gr. of finely ground calcium cyanamide are taken and mixed several times with distilled water in a small mortar; it is then decanted and about 950 cc. poured into a graduated litre flask. The mixture is shaken for 1 hour, made up to volume, shaken vigorously and filtered.

If the 1st. method is used 50 or 100 cc. of the filtered liquid (corresponding to 0.1 or 0.2 gr. of calcium cyanamide) are then taken, poured into

a 100 or 200 cc. graduated flask according to the amount of liquid used, neutralised with a 10 % solution of nitric acid and 2.5 or 5 cc. of 2.5 % ammonia added. A decinormal solution of silver nitrate is then added from a burette, the flask being shaken meanwhile. Account is taken of 1/20 cc. until the nitrogen combined as cyanamide is precipitated as silver cyanamide and only a slight excess of nitrate left in solution. The mixture in the flask is made up to volume with distilled water, and, after being well shaken, it is filtered, if necessary, through a double folded filter. The solution should be distinctly alkaline. Either 50 or 100 cc. of the filtered liquid are taken, acidified with 5 or 10 cc. of 10 % nitric acid by VOLHARD's method, i. e. with a decinormal solution of ammonium sulphocyanate and 2.5 or 5 cc. of a saturated solution of ammoniacal iron alum as indicator. Should chlorides or other halogenides be present, these are determined by acid solution by VOLHARD's method and taken into consideration.

By the 2nd. method, 100 cc. of the original solution containing 0.2 gr. of calcium cyanamide are placed in a beaker. This is neutralised with 10 % nitric acid, and, after the addition of 10 % ammonia, the nitrogen combined as cyanamide is precipitated as silver cyanamide by adding a slight excess of decinormal silver nitrate. During precipitation the flask should be continually shaken. The precipitate is collected quantitatively on the filter and carefully washed. The filtrate, while still moist, is placed in a Kjeldahl flask, which is shaken meanwhile, with 10 cc. of 50 % sulphuric acid, 0.6 gr. of mercury and 20 cc. of a mixture of 1 litre of sulphuric acid (density = 1.84) and 200 gr. of phosphorus pentoxide which neutralises it. The experiment is then finished by Kjeldahl's method. The filtrate must, of course, be free from nitrogenous substances.

713 – **Inoculation Tests on Lucerne and Lupin Seedlings, in Denmark.** – CHRISTENSEN, HARALD R., in *Tidskrift for Planteol*, Vol. 21, pp. 97-131. Copenhagen, 1914; and its original abstract) in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 46. Jena, 1916.

This paper contains the results of various experiments carried out from 1908 to 1910 at the various Danish agricultural experiment stations, to determine the effect of inoculated soil or pure cultures of bacteria on *Medicago sativa*, *M. lupulina* and *Lupinus luteus*).

Manuring experiments were made at the same time, principally to ascertain whether the value of the inoculation varies in unmanured soils and soils treated with calcium salts.

The tests show that, where *Medicago sativa* and *M. lupulina* are concerned, the inoculation with bacterial cultures gives the same results as that with inoculated soil, providing that good material of known origin is used. The American bacterial cultures, supplied by the Washington Department of Agriculture, proved entirely unsatisfactory, whereas the soil cultures prepared by the author himself, and those obtained from the "Biologisch-Chemisches Laboratorium" and the "Agrikulturbotanische Anstalt" of Munich, proved of value.

Experiments, carried out in many districts, in no wise confirmed the great virulence attributed to the pure bacterial cultures of the Munich "Agri

lturbotanische Anstalt ", which only have about the same effect as inoc- ıted soil. On lupins, at the Tylstrup Station, inoculated soil gave better ;ults than the bacterial cultures.

On the other hand, inoculations with bacteria are carried out more ra- lly, and may even prove less expensive, especially when the prepared soil mes from a great distance. With pure cultures the danger of introducing ngus spores or weed seeds into the soil to be inoculated is avoided. When oosing soil for inoculation, care should always be taken to ascertain that comes from districts free from weeds and where young Leguminosae ow a strong and healthy growth.

Crushed root nodules suspended in water (" Knuste Rodknolde "), e only suitable for local experiments as they spoil during carriage and not keep for long. Their action has not yet been closely investigated.

The specific action of the inoculations is more marked in unmanured ots than in those treated with mineral fertilisers. Presumably in the lat- r case, the chemical compounds, particularly the calcium carbonate, in- oduced into the soil before inoculation, facilitate the growth and increase the bacteria already in the soil. However that may be, during the 1st. id 2nd. year, the cultures exert a strong and well-marked action, even in anured soil, and favour the strong and luxuriant growth of the young ants.

The application of nitrate of soda in quantities of 178 lbs. per acre dur- g the first year (year in which the plants are sown), gave quite insignifi- nt results, and cannot replace inoculation. On the other hand, trogenous mineral fertilisers cause the weeds to grow at the expense of e leguminosae, clover or lupin, and should, therefore, not be used.

4 - **Report on Humogen.** — RUSSELL, E. J. in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 1, pp. 11-20. London, April, 1917.

This paper gives an account of experiments carried out in 1915 at the quest of the Board of Agriculture in order to determine the fertilising lue of " humogen ". This product is prepared by Prof. W. B. BOTTOM- Y'S method as follows : peat is first neutralised, bacterial decomposition then brought about to a certain point, and the peat finally inoculated with culture of nitrogen-fixing organisms.

The author reviews the results obtained by other workers — those of e discoverer, at Kew (1) of CHITTENDEN, at Wisley (2), of VOELCKER, at oburn (3), and at the Midland Agricultural College. These experiments ere largely unfavourable, whereas others, carried out at Sparsholt, were vourable up to a certain point, without, however, offering sufficient gua- ntees. Further tests made at the Lea Valley Experiment Station were lso unfavourable (4).

In the experiments described, carried out partly at Rothamsted and

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(1) See *B.* 1914, Nos. 410 and 1102. (*Ed.*)
(2) » *B.* 1916, No. 407.
(3) » *B.* 1916, No. 846.
(4) » *B.* 1914, No. 982.

partly at the Harper Adams Agricultural College, two qualities of humo were used, one prepared by the Manchester Corporation cleansing Depa ment, from peat from Chat Moss, the other prepared by the Entwis Mountain Peat Estate Company from peat overlying limestone depos Usually 10 cwt. per acre were used. The experiments were made w mangolds, pot plants and mustard in pots, and water cultures of barl

All the experiments gave negative results and do not permit the sumption that humogen possesses any particular agricultural value. T is all the more notable as it was said to be 50 times as efficacious as manu whereas it does not surpass any other organic manure with the same conte of nitrogen. The price asked, £5 per ton, is in no wise justified by the resu obtained. As these results contradict the statement made by the autho two circumstances must be borne in mind: *a*) good results were witho doubt obtained in the pot experiments at Kew and Wisley; *b*) the comp sition of humogen is obviously very variable.

Humogen, in the proportions used at Kew and Wisley (1 part to 7 8 parts of soil), may be a valuable addition to the compost used for pott up plants, but it does not appear to be superior to an equal amount of treated peat in an equally fine state of division. This finely-divided ganic matter is useful for several purposes in pots and when it forms 12 or more of the whole bulk it may have a favourable effect. It is qui possible that heavy dressings would have good effects on poor soils, but th would have to be on a far larger scale than is possible at present prices

The composition of humogen is far from uniform. Prof. BOTTOMLEY analyses show it to contain 4.310 % of total nitrogen. Analyses made Rothamsted of humogen from Manchester showed a nitrogen conten 0.570 % in the fertiliser as sent out, and of 1.29 % in the dry matte analyses of Entwistle humogen showed the corresponding values to be pectively 0.431 % and 1.32 %. In some samples Dr. VOELCKER fou 0.48 % of soluble nitrogen, in others only 0.08 %.

This variability is very unfortunate. It is possible that some samp have acted well in the field; it is certain that others have not. There no definite evidence that "bacterisation" really adds to the value of th peat. The wisest plan would seem to be to concentrate on experimen work and to stop all propagandist operations until some definite basis incontrovertible fact has been attained. It will take a long time to obta this result as the problem of utilising peat is sufficiently difficult to occu the whole attention of a laboratory for some years.

A proof of this paper was sent to Prof. BOTTOMLEY, who, in a let states that the product sent to the author as humogen was wrongly prepa and was in no way composed of bacterised peat.

715 - **The Use of Bakers' Ash as Artificial Soil Almost Free from all Mineral Organic Matter, Suitable for the Study of Plant Growth and the Influence various Chemical Fertilisers.** — GAUTIER, A., in *Comptes rendus des séances de l'Académie des Sciences*, Vol. 164, No. 26, pp. 985-986. Paris, June 25, 1917.

For the study, carried out during several years by the author in c laboration with P. CLAUSMANN, of the part played by fluorine in the grow

plants (1), it was necessary to have an artificial medium free from this ody and, as far as possible, from any other mineral or organic substance.

The author was able to make this medium by the use of bakers' ash. he ash is ground, heated till red, boiled with hydrochloric acid, and, ally, thoroughly washed with distilled water (2). This medium, very or in all salts and in fluorine, is excellent for cultures, and may be recomended to botanists as an excellent substitute for glass, cotton, silicious nd washed either with acids or pure water. The ash affects neither soil or water cultures.

6 - **Some Studies on the Germination of the Seed of *Oryza sativa* and *Zea Mays*.** — NAGAI ISABURO in *Journal of the Tokio College of Agriculture*, Vol. III, No. 3, pp. 109-158 + IX plates. Tokyo, July, 1916.

This paper gives the results of experimental and bibliographical researches into the physiology of the germination of the seed of Gramineæ general and of *Oryza sativa* L. and *Zea Mays* L. in particular. The work divided into 5 sections :

1. Rôle of the selective permeable septum of the seed covering in the viability of the
2. The seat of the selective-permeable septum in the seed covering.
3. Effect of *H* and *OH* ions on germination.
4. Rôle of oxygen on germination.
5. Influence of extremes of temperature on the germinative power.

The most important results were as follows :

1) Dessicated rice and maize grains are far more resistant than air-ied ones. Twenty-four hours steeping in chloroform, acetone, commerial absolute ethyl alcohol, picric acid (saturated solution), absolute ethyl ohol solution of thymol, naphthalene, α naphthol, and 6N sulphuric id (21 hours), is fatal to air-dried rice, whereas dessicated rice is harmed ly slightly or not at all. Similar results are observed when maize is treat with commercial absolute ethyl alcohol, absolute ethyl alcohol solun of naphthalene (1 %), resorcin (5 %), α naphthol (5 %), α naphthylmine (10 %), 6 N sulphuric acid and hydrochloric acid.

The greater resistance of dessicated grain is also observed when the ain is cut in hay so that the embryo is covered only by a thin layer of ndosperm.

The increased resistance of the dessicated seed may be due to 3 ssible causes : *a*) an increase in the protective action of the selective permeable septum; *b*) an increase in the filtering power of the endosperm tissue; an increase in the stability of the plasm of the embryo.

2) The selective permeability of the tegument probably has its seat in layer of cutinized cells immediately overlying the aleurone.

3) OH and H ions have no stimulating effect on the germination of ice, as is shown by the following table.

1 See *B.* April, 1915, No. 365. (*Ed.*)
2 Ordinary crushed quartz contains fluorine and gives up silica. (*Author*)

Liquids in which grains were steeped	Length of seedlings after 4 days
	mm
Caustic soda (NaOH) N/50	less than 1.0
" " " N/100	1.4
" " " N/1000	10.0
Tap water	9.9
Distilled water	15.0

The greatest development is found in distilled water.

4) Soaked rice grains germinate by inter-molecular respiration in an atmosphere of hydrogen gas, or in air from which the oxygen has been removed by potassium pyrogallate. In the absence of oxygen only the plumule develops, never the radicle. The different behaviour of the plumule and radicle is shown by the following results of an experiment in which the grains were kept for 48 hours in water and then exposed to the air.

	Growth in length mm.	
	first 48 hrs. in water	next 24 hrs. in air
Root	0.10	11.55
Shoot	10.55	2.60

5) The germinative power of rice and maize grains was unaffected by steeping for not less than 6 hours in liquid air. On the other hand, exposure to a high temperature (97-98° C) for 2 hours has a different effect on maize and rice; maize completely loses its germinative power, but rice, especially if dessicated, is only slightly affected.

717 - **The Influence of Water and Mineral Matter on the Germination of Peas.** — MIRANDE, L. and DEMOUSSY E., in *Comptes rendus des séances de l'Académie des Sciences*, Vol. 164, No. 26, pp. 979-985. Paris, June 25, 1917.

In all investigations on the relationship between germination and growth and mineral matter (1) excessive quantities of these substances have always been used, except in the case of toxins. For this reason the authors again took up this study using smaller quantities. They also recognised that certain useful elements have as powerful an action as some of the strongest toxins, the influence of calcium, for example, being felt in dilutions of some hundred-millionths only.

In order to ascertain these effects a certain number of precautions must be observed; chief among these is the use of pure water.

The re-distillation of commercial distilled water in glass, and, still more, its sterilisation in glass in the autoclave, must be avoided because the glass is attacked by the water, which then contains solutions of salts. However small the quantity of such salts may be it is still too great (8 to 10 mgr. per litre by the 1st. method, a quantity 50 times as great as that in which it begins to be active; 40 to 50 mgr. per litre in the 2nd. method).

(1) Amongst others Mlle. THÉRÈSE ROBERT'S remarkable *Thèse de la Faculté des Sciences de Paris*, 1915. (*Authors*)

It is this action on the glass which is the chief cause of the fact, observed y M. MOLLIARD, that seed germinates less well in water which has already een used for one or two germinations than in fresh water distilled and ste-lised in the glass. This is due to the fact that the salts resulting from the ction of the water on glass have been absorbed by the first seeds (1). This oes not occur if pure water in quartz tubes is used, If the seeds (peas) e germinated directly in pure water of a depth of from .4 to 5 mm. in uartz dishes, the inverse phenomenon results: each culture is superior the previous one by reason of the mineral and organic extracts given up to ie water through the medium of the seed-coats.

For the same reason, seedlings not to be grown out in germinating shes should be put, not in glass, but in quartz vessels as, in this case, the ots and even the stems grow better when exposed to the light.

Very different and very variable results are obtained according to ie kind of glass used, the method by which it has been treated and the shape id capacity of the vessel as this modifies the surface contact with the water

In their investigations, the authors excluded all glass vessels and used ily quartz ones and, as germinating dishes, well glazed porcelain. The res-lts obtained were comparable and very constant. The necessary water as obtained by distilling copper-free spring water twice consecutively in a rge Jena retort connected, without joints or corks, to a transparent quartz ondenser. 250 cc. of such water, reduced by evaporation to two drops, ould cause no trouble either with ammonium oxalate or barium chloride. nly an unavoidable trace, from 1 to 2 hundred-millionths, of organic mat-r is found. The best way of estimating the purity of the water is to ger-inate seeds in it both when uncondensed and when condensed to a tenth; ie results should be almost the same. This water should be kept free from ist in quartz or platinum vessels.

Germination in water only in quartz or glazed porcelain dishes was und unsatisfactory on account of the contamination of the water by the ed-coats. As substratum the authors used quartz, finely boiled with nitro-ydrochloric acid, washed with pure water, then heated in platinum. In ie absence of quartz, Fontainebleau sand similarly purified by nitro-hy ochloric acid and calcined was used.

When several seeds are placed in the same substratum, care must be ken that the roots do not touch either the neighbouring seeds or the glass ver of the dish.

In their experiments the authors used peas of the variety known as *ey winter peas*.

In order to avoid any modification of the elements within their coats y contact with the antiseptics, the seeds were not sterilised, but thorough-washed by being well-shaken with pure water.

After being soaked in pure water for 24 hours, the seeds were placed in roups of 10 either in quartz dishes or saucers, carefully washed with nitric id and half-filled with moist sand (40 gr. of sand and 9 to 10 cc. of pure

1. M. MOLLIARD admitted that this was due to toxins. (*Author*).

water or salt solution). The dishes were covered with glass and kept in a dark cupboard at a temperature of from 20 to 25° C. Only the roots were studied. These were measured after 6 days, when their growth is completely stopped in pure water.

Below is given the length of the roots taken under the above mentioned conditions in pure water. Each figure represents an average of 20 measurements, so that the general average corresponds to 200 separate observations.

Length of roots after 24 hours' soaking and 6 days' germination: series of 10 seeds. 26 mm. 23 mm.; 30 mm.; 25 mm.; 26 mm.; 27 mm.; 24 mm.; 27 mm.; 26 mm; 25 mm. General average: — 26 mm.

These greatly reduced measurements are in agreement with those noticed when similar seeds are grown in pure water in quartz tubes and exposed to the light. Even under these more advantageous conditions the roots of the peas hardly exceed 35 mm. in length, whereas, in glass tubes they may reach a length of 50 mm., and even as much as 70 or 80 mm. when distilled water is used in the glass tubes.

In pure water, growth stops on the 3rd. or 4th. day, the main root remains smooth and rootlets are rare and usually absent. The general appearance is that of a stunted plant quite different from that of plants grown in ordinary distilled water, which always contains a little lime.

The authors are not of the opinion that pure water has a toxic action but believe that it is merely insufficient to maintain the metabolism of germination.

The salts removed from ordinary glass by water are composed, chiefly of a mixture of alkaline silicates and calcium sulphate, and the authors' experiments show that only the calcium has any action. This brings out a new function of this metal, misunderstood up to the present because the culture media have been insufficiently purified, that of influencing growth when present in infinitesimal quantities.

718 - "Giovanni Raineri" and "Emilio Maraini", New Varieties of Autumn Barley Selected in Italy. — STRAMPELLI, NAZARENO, in *L'Italia Agricola*, Year 54, No. pp. 208-209 + 1 plate; No. 6, p. 240 + 1 plate. Piacenza, May 15 and June 15, 1917.

Since 1911, studies in the selection and hybridisation of barley have been carried out in the experimental plots in the Leonessa plateau (Province of Aquila). Over 300 varieties were obtained, two of which prove very productive, and were called "Giovanni Raineri" and "Emilio Maraini". They are illustrated by two plates and described as follows:

"GIOVANNI RAINERI" BARLEY. — Average height of the plant 90-100 cm.: *culm* strong, resistant to lodging, curved at the top; *ears* six-rowed, average length about 10 cm., about 80 grains per ear; *glumes* narrow, almost parallel, ending in small, thin awns of a maximum length of 16 mm.; *pale* not very thick; the outer side of the pale has, on its lateral veins, a row of very small teeth; *awns* of average length, 15.66 cm.; the *pale* and *Spikelet axes* have long, shiny, silky hairs; *grain* of average size: 7 mm.

mm. × 2.5 mm., mealy, containing 68.5 % starch and 8.1 % protein ; 0 weigh 50.17 gr.

The composition of this barley and its thick pale make it suitable for wing. At Leonessa it gave during the last 4 years an average yield ton per acre, with a minimum of 0.71 tons in 1915 and a maximum of ; tons in 1914.

This barley does fairly well even in Apulia, but it is really best adapted entral and northern Italy, especially to hilly and mountainous districts. hould always be sown early in autumn.

" EMILIO MARAINI " BARLEY. — *Culm* strong, of an average height 5-70 cm.; *ears* six-rowed, with an average length of 4.5 cm.; average nber of grains per ear 70 ; *glumes* fairly narrow, lance-shaped, ending ine awns 19 to 20 mm. long ; *pale* very small, with long, silky hairs, ly thick, with series of small teeth on the lateral veins down almost whole length of the outer side ; *awns* average length about 12 cm.; ns glutinous, containing 67.03 % starch and 9.40 % protein, average surements 8 × 3.7 × 2.9 mm., weighing 48 gr. per thousand.

During the last 5 years this barley gave at Leonessa an average yield .08 tons per acre, with a maximum of 1.31 in 1912 and a minimum of ; tons in 1915.

It resists drought well and when grown at Foggia gave better results n " Giovanni Raineri " barley ; in a dry year it yielded 0.55 tons acre.

- Observations on the Inheritance of Anthocyan Pigment in Paddy Varieties. — HECTOR, G. P., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VIII, N°. 2, pp. 89-101 + II plates. Calcutta, November, 1916.

A considerable proportion of the paddy varieties grown in India are racterised by the presence of reddish and purplish pigment distributed ughout various parts of the plant. In this connection, the plants studmay be divided into 4 groups.

1) Leaf-sheath, apiculus of glumes, and stigma coloured.
2) Leaf-sheath and apiculus of glumes coloured ; stigma colourless (white).
3) Apiculus of glumes and stigma coloured, leaf-sheath colourless.
4) Apiculus of glumes only coloured.

Group 1 is the commonest ; groups 2, 3 and 4 contain comparatively individuals. GRAHAM observed that all plants with a coloured leaf-sheath (or purple) have an apiculus of the same colour ; this led him to believe t the converse may also be true and that, in groups 3 and 4, not only the ulus is coloured, but also the leaf-sheath, but so slightly that the colour ard to detect. The stigma, on the other hand, is independant of the leaf ath and apiculus, and though these are coloured, the stigma may be r colourless, of the same shade or darker.

The most important results of this study may be summarised as fol-s : 1) In 1912, 48 natural crosses characterised by the presence of red ment in the leaf-sheath were isolated. In 1913 the F_2 generation was sed of red and green individuals in the approximate ratio of 9 : 7.

If **R** be considered the factor which, in presence of a chromogen base **C**, produces the red colour, it may be supposed that the coloured parent was of the constitution **CR** and the green (colourless) **cr**. The formula of the F_1 hybrid will then be **Rr Cc**, and the F_2 plants will have the following constitutions: – 9 **RC** (red); 3 **Rc** (green); 3 **Cr** (green); 1 **cr** (green); i. e. a ratio of 9 red: 7 green. This would give 4 kinds of reds — **RRCC**, **RrCc**, **RrCC**, **RR Cc**—, and would explain the different shades of red observed in coloured members of the F_2.

2) In a few cases the simple ratio 3 : 1 has been obtained. In 1913 crosses were made between a wholly green variety (Pookhi), and a variety with a purple stigma and red leaf-sheath and apiculus (Pankhiraj). The F_1 plants (1914) showed the colour characters almost wholly dominant. The F_2 plants (1915) were distributed as follows:

	Coloured leaf-sheath apiculus and stigma	Colourless	Ratio
No. 1 Pookhi ♀ × Pankhiraj	67	30	2.2 : 1
No. 2 " × "	200	67	2.9 : 1
No. 3 " × "	267	69	2.8 : 1
No. 4 " × "	116	30	3.8 : 1
No. 5 Pankhiraj ♀ × Pookhi ♂	365	121	3.0 : 1
Total . . .	1 015	317	3.2 : 1

The colour in the leaf-sheath, apiculus and stigma behaves as a single unit and may be due to one single factor.

3) The author found that the purple colour frequently present in the stigma does not correspond to the colour of the leaf-sheath and apiculus and is due, not to two factors **R** and **C**, but rather to the simultaneous action of 3 factors, **R, C** and **P**, the last of which is found in the stigma only.

F_1 plants, with red leaf-sheaths, red apiculus and blue-black stigmas gave, in F_2, plants with coloured and with white stigmas in the ratio 437 : 665. Assuming that the F_1 hybrids have the formula **Cc Rr Pp** they will, on selfing, give plants of the following constitution.

Number	Constitution	Stigma	Leaf-sheath	Apiculus
27	**CRP**	coloured	red	red
9	**CR**	white	"	"
9	**PR**	"	green	green
9	**CP**	"	"	"
3	**R**	"	"	"
3	**C**	"	"	"
3	**P**	"	"	"
1	**crp**	"	"	"

The ratio between plants with coloured and with white stigmas is therefore, 27 : 37, or 1 : 1.3. The colour in the stigma would thus appear to be due to the presence of 3 independent factors, **R, C** and **P**, and the phenomena of the distribution and transmission of pigments in rice may be explained by Mendelian laws.

10 - **On Cultural Bud Mutations of some Species of *Solanum* and on the Acclimatization in France of some Bolivian Species.** — VERNE, CLAUDE, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 23, pp. 637-642. Paris, June 20th, 1917.

I. CULTURAL BUD MUTATIONS. — In this paper the author gives the results of experiments carried out in 1914-1915-1916 in collaboration with L. GINET. The work was undertaken in order to substitute for the old species younger and more productive new ones, more resistant to disease. The tests were made in various soils, at different altitudes and under varying climatic conditions. No definite data on the influence of altitude were obtained, and the results given concern only the nature of the soil and the climate.

Interesting results were obtained at Montmelas (Rhône), in the Ain district, at Bourg d'Oisans (Isère), and at Sisteron (Lower Alps), but the most important work was done at Gières (Isère). The author reported the following new species to the Academy of Agriculture.

4. 1. — *Solanum Maglia*, set at Gières in 1913, gave numerous long, semi-cylindrical average tubers with a fine, smooth, reddish-violet skin. The growth of the plant still leaves something to be desired, but it improves each year. It has stiff stems from 1 to 1 $^1/_4$ feet high which have not yet flowered. It is an early species.

4. 2. — *S. Maglia*, set at St. Martin d'Uriage in 1914. This plant is one of the finest obtained. Slender at first, it is now thick and leafy; the leaves, which have grown considerably, have changed from light to dark green and have taken an upward curve; the flower is still white, but is much larger, and the petals firmly joined. The tubers have increased in weight from 5 gr. to 185 gr., their colour has changed from light violet to pink; they are clustered at the foot of the stalk, in sufficiently large numbers for the plant to be classed as very fertile and fairly early. The flesh of the tubers is white, sweet and succulent; the inner pinkish skin colours the outer smooth, transparent skin. No traces of disease have as yet been found on the plant or tubers.

27. 1. — *S. Commersoni*, set at Gières in 1913. Mutation, light yellow, fertile and early; plant vigorous, of a lightish green colour, straight, stiff stalks; tubers large (255 gr.) round or oval, sometimes indented, tasty, ripening all together at the end of July.

27. 2. — *S. Commersoni*, set at Gières in 1913. Of medium strength, leaves grained; flowers rotate, pale violet, variegated; tubers long, indented, with smooth, fairly fine skin.

27. 3. — *S. Commersoni*, set at Gières in 1914. Similar to the preceding.

27. 4. — *S. Commersoni*, set at St. Martin in 1914 and since grown at Gières. Plant low, spreading, thick, with pale violet stalks, dark green leaves, white, rotate flowers; tubers numerous, large and pale yellow. A very fertile and very strong species.

27. 5. — *S. Commersoni*, set at Sisteron in 1915.

27. 6. — *S. Commersoni*, set at Montmelas in 1916.

II. BOLIVIAN SPECIES BROUGHT TO FRANCE IN 1911. — *Lac Titicaca*

(Naqui, altitude = 12 120 feet). Plant strong, straight, reaching a height of 6 ½ feet; flowers lavender-coloured on a long, jointed and branching stalk; tubers round, dark brown, skin violet inside and black outside, flesh white and most tasty of all; never any sign of disease of the aerial parts; tubers keep perfectly.

Papa-Amarillas (La Paz, altitude = 11 828 feet). Plant fairly vigorous, of similar appearance to the preceding; foliage light green, flowers pale lavender; tubers round, pinkish-brown, variegated. Quality, keeping powers and resistance similar to the preceding species.

Ymill-imilla (Province of Ullona, altitude = 12 364 feet). — Plant straight, very strong though slightly slender, capable of reaching a height of 5 feet, foliage pale green, flowers white; tubers round, pale pink, small but numerous and very healthy.

721 – **Thirty-seven Years of Spruce Selection, in Austria.** — Reuss, in *Centralblatt für d. gesamte Forstwesen*, Year 42, Pts. 11-12, pp. 383-417. Vienna, November-December, 1916.

The results given in this paper are a continuation of those published in the same journal in February and April, 1884. The first of the 3 series of experiments, carried out in 1878 on the Colloredo-Mannsfeld estates at Dobrish, Bohemia, was undertaken to study the duration of the germination of spruce seed. Only the course of germination and its results till the period when the seedling becomes physiologically independent were included. The second series dealt with the maturation period of the seed, and, consequently, included sowing, germination and the care of the plant till, at 4 years, it is set in the plantation. The third series concerns the "puberty" of the plant (period at which the trees begin to bear fruit), and the influence of the age of the tree on the quality of the seeds from the point of view of pure selection, and had, therefore, to be continued from the first stage till the age for felling was reached. This series of experiments of 37 years was carried out constantly under the personal supervision of the author; it is now being continued by the Imperial Forestry Experiment Institute at Mariabrunn. The present paper gives the results obtained up to the present and a brief summary of those published in 1884.

The experiments in pure selection were made with 21 kinds (classes) of spruce seed taken from controlled plants varying between the ages of 23 and 142. The results showed that, as a rule, the size of the seeds decreases with the age of the parent plant, and that small seeds predominate in trees of more than 46 years. The results obtained led to no definite proof that the age of the tree has any influence on the germinating energy (Keimkraft) of the seed; nearly all the classes reached the highest germination percentage in the 5th. and 6th. week, but the energy during this time was totally different.

The experimental plants, 18 000 in round figures, were planted at the age of 4 years in an area of about 8 ½ acres, in the spring of 1883.

The weight, length of the roots, strength and height of 15 plants of each class were previously taken. These figures showed the average growth and were published in table form in the first paper. They show an astonish

ing irregularity and diversity, but, as a rule, the oldest trees appear to give the highest yields. The age of the tree seems to have no influence on the mortality of the seedlings, or if there is any such influence, it is subordinate to other causes. Generally speaking, the percentage of plants that die increases with the age of the stock plant.

In 1899, when the plantations were beginning to develop, a census of the experimental plots was taken. During the summers of 1889 and 1890, when the annual growth was over, the trees were counted, the individual and the average height taken and tabulated. These figures throw no clear light on the influence of the age of the tree on the value of the seed from the point of view of selection and growing capacity. The percentage of losses for the years 1888 and 1890, and the data on the growing capacity are given in graph form.

In the autumn of 1916 the average diameter was calculated in each plantation; the diameter of the base of the trunk was also determined: 1) for the number of trunks present, 2) as average per tree, 3) for the unit-number of 100 trunks, which, with the exception of one plot, represents the minimum and could therefore, be used for comparison. Sections were taken at breast heigth from the felled trees, and, from these was calculated the strength of the wood in 1904, i. e. in its 25th. year.

The results of the 2nd. series of experiments, from 1889 to 1916, are summarised as follows:

1) Neither the observations, measurements, calculations nor data obtained since 1884, nor the condition of the experimental plots, now 37 years old, give any definite information with regard to the influence of the age of the stock plant on any of the biological phenomena and on the growth of the progeny. On the contrary, external factors (quality of the soil, thickness, formation of clumps, etc.) have the greatest influence on growth in all the trees examined. Only a comparison of the greatest differences of age shows that an old stock plant has a favourable influence on the growth of the progeny until the maximum limit for felling is reached, and that, from that moment, the influence is unfavourable.

2) This does not apply to growth in height which seems much more sensible to environmental difference than growth in thickness. Growth in height becomes gradually less in proportion as the age of the parent-plant increases, but no trustworthy explanation of this phenomenon can be found in the habitat. The control experiments, obviously carried out under unfavourable enviromnental conditions give opposite results — the growth in height of the progeny increases with the age of the stock-plant. The series of experiments ends with trees of 120 years.

3) The individuality and internal constitution, rather than the age of the stock plant seem to influence the growth of the progeny. The graphs constructed from all the average values obtained from calculations and measurements show a remarkable analogy with the curves constructed from the figures given in the tables. This analogy shows the prominence of the peculiarities of the parent plant in its descendants.

4) Seeds of plants from different altitudes show, in many directions,

a different behaviour in the development of the descendants and confirm Prof. CIESLAR's theory of "climatic varieties".

In studying the theory of heredity, special attention was given to the two varieties, red-coned *Picea excelsa* var. *erythrocarpa* (early or red spruce) and the green-coned *P. excelsa* var. *chlorocarpa* (late or white spruce) because it has frequently been stated that the latter variety would facilitate the destruction of *Liparis monaca*. A study was also made to see whether early and late spruce seeds are constant with regard to their characters, and whether it would be possible to grow plantations of the late varieties, or, at least, to cultivate them in conformity with the object in view. The author calls "individually constant" the colour which returns regularly each year on the same plant and the peculiarity of an early start in growth in the red-coned variety, and a late start in the green-coned variety.

The *chlorocarpa* or *erythrocarpa* varieties cannot be grown immediately in pure plantations with any certainty that the seed is constant, but by careful selection, either of these varieties may be satisfactorily grown. The period of growth and the colour of the cones vary and are influenced by cross-fertilisation. While the stock form of the mother plant predominates in the progeny, the other form also occurs in proportion as the female or male cell has an equal or superior power.

The risks from late frosts are very much reduced though not completely eliminated in a late-flowering variety even if there is a difference of 14 days only. Nevertheless, the mere fact of reducing the dangers from frost repays the trouble taken to grow many late varieties in spruce plantations. By the lateness of their period of vegetation such trees impede the birth and growth of the larvae of *Liparis monaca*, and thus present a further advantage.

The late start of growth in spring also prolongs by 14 days the possibility of using the *chlorocarpa* variety for the cultivation of plants. Moreover, by reason of its narrow, rounded crown, this form is less liable to be broken by snow and is more resistant to weather.

Determinations of the specific weight of sections taken at breast height showed that the technical properties of the wood are not influenced to any vital extent by the age of the parent plant.

722 - ***Musa paradisiaca* s. sp. *seminifera* in Banana Selection.** — See No. [illegible] this *Bulletin*.

723 - **Fall-Sown Grains in Maryland and Virginia.** — STANTON, I. R., in *United States Department of Agriculture, Farmer's Bulletin* 786, 23 pp., 6 figs. Washington, D. C., February, 1917.

This bulletin contains a description of agricultural methods and procedures concerning winter cereals based on experiments carried out in the two states and intended for the use of practical agriculturists. The following have proved the most satisfactory varieties for these states:

WHEAT: 1) *bearded*: Dietz, Fulcaster, Gipsy, Rudy, Stoner; 2) *beardless*; China, Currell (Currell Prolific), Fultz, Leap (Leap Prolific), Poole, Purple Straw, Dawson (Dawson Golden Chaff).

RYE: Abruzzis, Giant Winter, Virginia Winter.
SPELT: Alstroum, Red Awnless.
OATS: Culberson, Red Rustproof, Winter Turf.
BARLEY: Tennessee Winter, Union Winter.

24- **Belotourka, Richelle and Oregon, Good Varieties of Wheat for Chili.** — FROMMHERZ, HERIBERTO, in *Boletín de la Sociedad agrícola del Sur*, Vol. XVII, No. 2, pp. 14-15. Concepción (Chili), March-April, 1917.

Numerous varieties of wheat have been tested at the Santiago Agricultural Station of Chili. Those which gave the best quantitative and qualitative results were Belotourka, White Naples Richelle and Oregon, which yielded respectively 4280 lbs., 3224 lbs. and 3 226 lbs. per acre.

The two first varieties were but slightly attacked by rust (" polvillo "), the third suffered from attacks of " polvillo colorado ".

Private farmers also made very successful experiments on a small scale with these wheats.

The Santiago Agricultural Station recommends Belotourka for the central valley and secondary valley of the O' Higgins Province, in the north; White Richelle for dry or irrigated soils, especially those of Santiago, in the north; Oregon for irrigated soils all over Chili.

25- **Experiments in Oat-Growing in the North of Sweden.** — RHODIN, SIGURD, in *Kungl. Landtbruks Akademiens Handlingar och Tidskrift*, No. 2, pp. 150-160. Stockholm, 1917.

This paper contains the results of many experiments on 4 varieties of oats, Björn, Orion, Mesdag and Nordfinsk (black) carried out from 1913 to 1915 in two different districts — the Stockholm University agricultural experiment field and the Robertsfors farms, in the north of Umeå, beyond the 64th. degree of northern latitude.

These 4 early varieties have a very short vegetative cycle and, even though sown late, ripen before the early autumn frosts put an end to all plant growth. Sowing is usually a month later at Robertsfors than at Stockholm; the respective dates for the 3 years of the experiment were:

	Stockholm	Robertsfors
1913	May 6 th.	June 4th.
1914	April 29th.	June 9th.
1915	April 30th.	June 5th.

YIELD IN GRAIN. — The Orion variety gave the best results, both at Stockholm and at Robertsfors, as the following relative indices show:

Stockholm		Robertsfors	
Orion	100.0	Orion	100.0
Björn	98.5	Nordfinsk	92.9
Mesdag	94.3	Mesdag	92.4
Nordfinsk	93.2	Björn	98.7

During the 6 years 1911-1916, the Orion variety gave, at Robertsfors, an average of 2504 lbs. per acre; it is, therefore, the most satisfactory for the cold Norrland regions.

YIELD IN STRAW. — The Orion variety again leads with an average yield of 6459 lbs. per acre for the years 1911-1916. A high yield in straw is a distinct advantage when early autumn cold prevents the grain from ripening, because the large fodder harvest obtained by cutting the oats partly compensates for the loss of grain. A comparison between Orion and the other varieties gave the following relative indices:

	Stockholm		Robertsfors
Orion	100.0	Orion	100.0
Björn	91.3	Nordfinsk	95.2
Nordfinsk	88.3	Mesdag	89.8
Mesdag	82.5	Björn	82.7

In both yield of straw and in yield of grain the Bjorn variety, which holds the 2nd. place at Stockholm, only holds the 4th. at Robertsfors.

DURATION OF VEGETATIVE CYCLE. — The data obtained at Robertsfors for the periods 1913-1915 and 1911-16 are given below:

	1913-1915	1911-1916
	days	days
Mesdag	95.3	91.6
Björn	96.0	95.3
Nordfinsk	97.3	97.3
Orion	98.9	97.1

These 4 varieties are, therefore, very early and are suited to the most northern latitudes in which oats are grown

726 - **Leguminous Crops in Desert Agriculture.** — HOWARD, C. and HOWARD, G. L. C. in *The Agricultural Journal of India*, Vol. XII, Part 1, pp. 27-13. Calcutta, January 1917.

The development of Indian agriculture is largely a problem of increasing the production of the soil. This increase in production includes the conquest of the desert by means of irrigation. Irrigation alone, however, is not sufficient as the deficiency of desert soil in organic matter soon results in poor crops. As green manuring — the obvious remedy — does not appeal to the cultivator, the problem is to find a way by which the organic content of these desert soils can be increased, and at the same time be profitable.

The solution is to be found in the extended growth of leguminous fodder crops like *shaftal* (*Trifolium*), lucerne, *berseem* (*T. alexandrinum*), *senji* (*Melilotus indica* and *M. alba*), and *guár* (*Cyamopsis psoraloides*, D.C.), which are largely grown for green fodder round the towns of North-West India. But the area under these fodder crops falls off, as there is little sale for the green fodder and no proper methods of drying and storage exist. Once a method of drying and baling these fodder is found together with a market for the produce, the cultivation of these crops will develop rapidly to the benefit both of the soil and the cultivator, the nitrogen-fixing properties of leguminous crops being well known. Again, the extended growth

these crops will benefit the efficiency of the ox, which is very low because the lack of nutritious food, the working cattle being given food with too w an albuminoid ratio. This defect can be considerably obviated by le use of properly dried and stored leguminous crops — *shaftal*, lucerne, *rseem* or *senji*. Analyses of these fodders show a high albuminoid ratio nging from 1 :3 to 1 : 4. Feeding trials on Army horses at Quetta showed at working animals like horses and mules thrive on comparatively small nounts of such fodder.

During the last few years, a considerable amount of attention has been id at Quetta both to the enrichment of the desert soil with organic mat- r by the growth of leguminous crops and also to the best methods of drying d baling the produce. This has opened the way to the development of proved animal production and the building up of a new and profitable dustry for supplying baled leguminous fodders for Army purposes and r ordinary working cattle. The present paper deals with the progress ade in these matters up to the end of 1916.

The Drying and Baling of Leguminous Fodders. — The two most suitable guminous fodders for growth in the upland frontier valleys appear to be ersian clover or *shaftal* (1) and lucerne. The former is an annual which ould be sown in early September and which gives as many as 6 cuts before ying down after flowering in June. Lucerne is perennial, but ceases to e profitable in the Quetta valley after five or six years.

In Baluchistan, both *shaftal* and lucerne do best on manured land, but ie former does much better than lucerne as a fresh crop on poor land. After king *shaftal* crops for 2 or 3 years, the land is fit for growing lucerne.

The annual yield of green *shaftal* on land in fairly good condition near uetta is high, being over 33 tons to the acre in 1915-16, giving a value of s. 371 an acre.

These fodders should both be cut as often as possible so as to obtain ie most nutritious fodder and the maximum yield. Drying should be nducted very carefully, the retention of sufficient moisture in the dried oduct having to be provided for. Overdrying causes loss of the valuable aves and consequent reduction of food value. Drying should be carried t in stages. *Shaftal* dries much more slowly than lucerne, and after tting should be spread out to dry for a day or two, then turned and left nother day. It is then collected into heaps and pressed down firmly to heck the rate of drying. If done at the right time, a slight fermentation egins and on the second day the fodder begins to be slightly warm. The eaps are now opened and spread out to dry off excess moisture, taking are not to overdry. After remaining a few days in heaps the fodder can ither be stacked or else baled at once. Lucerne should be collected into eaps on the third day, and then the heaps opened out once or twice af- erwards. Once it is dry enough it should be baled immediately as it dries ery rapidly in the stack

(1) The cultivation of *shaftal* is dealt with in detail in the *Agricultural Journal of India*, Vol XI, No 1, 1916.

The preparation of the baled fodder requires some capital and is therefore beyond the means of the ordinary cultivator. It should, therefore, be carried out at centres where ample supplies of green fodder can be produced and where there is little competition for the available supplies such as exists in large towns and military cantonments. A few miles out of the town, however, the conditions are different and the establishment of baling stations would be sure to lead to the extension of *shaftal* and lucerne cultivation for baling purposes only. The type of bale produced should conform to the local requirements. In Baluchistan, *shaftal* baling is carried on from March till early June, and lucerne baling comes in May and lasts till October.

The Feeding value of Shaftal and Lucerne Hay. — The *shaftal* and lucerne hay prepared at Quetta are equal to the very best grades of these fodders made in Europe. Analyses at Pusa showed that they had the following composition :

Composition of shaftal and lucerne hay at Quetta.

	Shaftal (in bales)	Lucerne (in bales)
Moisture	15.86	3.14
Oil	2.19	3.32
Albuminoids	14.19	15.48
Soluble carbohydrates	39.98	46.30
Woody fibre	13.80	17.70
Soluble mineral matter	12.88	11.83
Sand	1.19	2.23
Total	100.00	100.00
Total nitrogen	2.48	2.98
Albuminoid nitrogen	2.26	2.48
Albuminoid ratio	1 : 3.2	1 : 3.5

These fodders are evidently too concentrated for use by themselves. Feeding trials with Army mules and horses showed that a ration composed of equal parts of *bhusa* (1) and *shaftal* hay, with an albuminoid ratio of 1 : 5, was suitable in every respect. For light work, it was found that the proportion of bhusa could be increased. A ration consisting of 2 parts of *bhusa* to 1 part of *shaftal* hay would give food with an albuminoid ratio of 1 : 6.2 which would keep horses, mules and cattle in ordinary work in good condition without the addition of grain. For Army purposes the

(1) *bhusa* = chopped wheat straw of the assumed composition of fats 0.98 %, albuminoids 3.01 %, and soluble carbohydrates 37.93 %. *Ed.*

ostitution of *shaftal* or lucerne hay for grain as the main albuminoid rried together with the reduction of the amount of *bhusa* would lead to great reduction of weight as far as transport work is concerned.

Leguminous Fodders in India. It will be seens that a sure market is re-ired for the successful spread of leguminous fodders in North-West In-. For this end, if the Army largely adopts them their success is cer-n. Further, these fodders will enrich the soil and improve the efficiency both working and milk cattle, as well as being invaluable for famine re-ves. The land would then be more intensively and widely cultivated d would in addition, support a larger population. The nitrogen-fixing guminous fodder crops can effect all this, provided that the market is ured.

7 - **Effect of Inoculation on Growth of Lucerne and Lupin.** — See No. 713 of this *Bulletin.*

8 - **Factors Causing Variation in the Yield of Camphor in the Florida Camphor Tree.** — HOOD, S. C., in *The Journal of Industrial and Engineering Chemistry*, Vol. 9, No. 6, pp. 552-555. Boston, Pa., June, 1917.

In view of the recent increase in the commercial cultivation of the mphor tree (*Laurus Camphora*) in Florida the author gives full details of e various factors on which depend the yield in camphor of the leaves d twigs of the tree, and, at the same time, takes full account of the diffe-nce in the methods employed in Florida, Japan and Formosa. The data e based on observations made in Florida between 1907 and 1912 on cam-or trees grown under varying conditions.

These observations show that the highest yield of camphor is obtained om the leaves and twigs of the last growth taken during dormant season; n the other hand, these are left on the plant for another season, the yield decreased. The yield of the young wood is very slight and has no im-rtance from an economic point of view. Vigorous pruning, giving rise a profuse growth, causes a low yield from the leaves and twigs and a very ght formation of camphor in the wood. On the other hand, clipping the ves and branches as is done for hedges tends to increase the camphor ld of subsequent harvests. In order to put a plantation to the most nomical and practical use, the maximum quantity of high-yielding leaves d twigs, with the minimum quantity of woody parts, should be obtained. re should be taken not to wound the plants in any way. The slightest ade is deleterious to the camphor tree and tends to diminish the percen-ge of camphor in the leaves, diminishing at the same time the leaf sur-ce of the plant.

Varying climatic conditions and rainfall cause marked annual varia-ns. Moreover, since the yield in camphor depends largely on the growth, rcing gives a larger quantity of richer gum-yielding material.

The highest percentages of camphor were obtained from the best soils, rticularly from heavy loam, whereas they showed a marked decrease in portion as the soil became lighter and more sandy. Exceptions to this le were observed in very poor soil, where the plants were stunted, and ntained a fairly high percentage of camphor in their leaves.

729 - **The Acreage of Fruits, Bearing and Non-bearing, by Counties, in 1916 in California.** — WELDON, G. P., in *The Monthly Bulletin of State Commission of Horticulture*, Vol. VI, Nos. 3-4, pp. 115-117. Sacramento, California, March and April, 1917.

There are, in the service of the Californian Horticultural Commission, 47 county commissioners who supply accurate details concerning the development of fruit-growing in their respective counties.

The following figures are abstracted from the table given by the author, refering to the area occupied by fruit trees in each county. Only the total figures for California are given below.

Acreage of fruit-orchards in California during the year 1916.

	Total area 798 007 acres	
	Bearing (acres)	Non-bearing (acres)
Almonds	20 476	20 652
Apples	19 602	22 150
Apricots	77 977	18 739
Berries	15 954	765
Cherries	8 240	5 211
Figs	7 397	3 175
Lemons	21 094	12 [illegible]
Olives	16 114	12 041
Oranges	113 729	57 279
Peaches	82 834	25 [illegible]
Pears	18 039	22 253
Plums	10 436	6 [illegible]
Prunes	101 160	30 214
Walnuts	35 384	22 [illegible]

730 - **An Edible Seed-Bearing Banana for Temperate Climates.** — ROBERTSON, PRINCESWKY A., in *La Petite Revue agricole et horticole*, Year 23, No. 535, p. 101. Antibes, May 8, 1917.

In his Botanical Garden ("Les Tropiques", St. Helena, near Nice) the author has a banana tree which has been identified as *Musa paradisiaca* L., sub-species M. *seminifera* (Lour.) Baker.

This plant forms a cluster of 23 ft. and is very fine; its resistance to weather is rather greater than that of the non-seed-bearing sub species *M. paradisiaca* s. sp. *sapientum*. The under side of the young leaves is purple-red, which disappears as the leaves reach their full growth. The floral stem bears 11 to 14 flowers per hand instead of 8; the fruit is only a third, or, at the most, half the size of those of ordinary banana trees and, when ripe, remains green or turns very slightly yellow. The fruit, though it cannot be compared with that of the usual cultivated tree, is fairly fleshy, very sweet and pleasant to the taste, and perfectly edible.

This banana-tree did not suffer from last year's cold and snow. Its resistance could certainly be increased by selection of the plants obtained

m the seed; it might also be possible, by selection, to obtain trees with
seeds and a more pleasant taste so as to form varieties well suited to
perate climates. Hybridisation would prove interesting, especially with
Cavendishii Lamb.

- Notes on Hybrid Direct Bearers in the Seine-et-Marne District, France. — SALOMON, R., in the *Revue de Viticulture*, Year 24, Vol. 44, No. 1176, pp. 25-30; No. 1181, pp. 105-108. Paris, January 11 and February 15, 1917.

I. — RESISTANCE TO MILDEW. — The work, carried out in the experimental fields in the Seine-et-Marne district, dealt only with early varieties during their first period of maturity and second early period. Five vines were planted in a position facing east, cold, chalky, exposed to frost, and from midday, over-shadowed by high trees; that is to say, all the conditions were highly favourable to the growth of *Peronospora*. The investigation was carried out during 6 years, dating from the first harvest. The direct bearers always benefited by the first treatment of the viniferas, so that each year, immunity was perfect. Nevertheless, in 1910 and 1915, even mildew was exceedingly prevalent, certain hybrids proved not to be immune and were removed. The following varieties proved immune both as regards fruit and leaf mildew.

Baco: 21-23 No. 1, 22-A, 43-23; — *Castel*: 2 528, 3 343, 4 001, 8 930, 16 525, 19 092; *Couderc*: 106-51, 146-51, 251-150, 272-60, 28-112, 7 103, 7 104, 7 105, 7 120, J 503, called *Oiseau bleu*, 4 401, called *Oiseau rouge dit La Madone*; — *Gaillard-Girerd*: 2, 157, 194; *Oberlin*: 595, 663, 782; — *Seibel*: 117, 128, 131, 156, 181, 782, 802, 845, 1 000, 1 077, 2 004, 2 006, 2 010, 2 620, 2 719, 2 734, 2 793, 2 828, 2 834.

FERTILITY. — The following were found particularly fertile:

Baco: 22 A, 24-23 No. 1, 43-23; — *Castel*: 2 528, 4 001, 16 525, 19 092; — *Couderc*: 7 106, 7 120; — *Oberlin*: 595. — *Seibel*: 782, 131 (the strength of this plant leaves nothing to be desired, it should be grafted on to stronger stocks).

ALCOHOL CONTENT: As regard alcohol content, density tests led to the following classification:

Gaillard-Girerd 194 — 11°. — *Castel* 2 528 and *Oberlin* 595 — 10°. — *Baco* 24-23 No. 1 and 22 A — 9 ½°. — *Gaillard-Girerd* 157, *Oberlin* 663 and 782, *Seibel* 2 719 — 9°. — *Baco* 43-23, *Gaillard-Girerd* N. 2 — 8 ½°. — *Castel* 3 343, *Couderc* 106-51, J 503, 4 401 — wanting. All the others vary between 6° and 8°.

PRACTICAL CLASSIFICATION.

1) *Baco* 24-23 No 1; 2) *Gaillard-Girerd* 2; 3) *Seibel* 2 834; 4) *Castel* 3 343; 5) *Oberlin* 595; *Couderc* 7 106; 7) *Couderc* 7 120; 8) *Couderc* 7 104; 9) *Couderc* 7 103; 10) *Seibel* 2 010; *Gaillard-Girerd* 194; 12) *Gaillard-Girerd* 157; 13) *Castel* 16 525; 14) *Couderc* 4 401; *Seibel* 131.

Then come:

Baco: 22A and 43-23; *Castel*: 2 528, 4 001, 8 930, 19 092; *Couderc*: 106-51, 272-60, 28-112; *Oberlin*: 663, 782; *Oiseau bleau* J 503); *Seibel*: 181, 845, 1 000, 2 006, 2 719, 2 793, 2 828,

And, lastly:

Couderc: 146-51, 251-150; *Seibel*: 117, 128, 156, 187, 782, 802, 1 077, 2 004, 2 620, 2 734.

VINIFICATION. — Numerous vinification tests proved that, for all the direct bearers, better wine is obtained if mixed varieties are used in t vat. In order to obtain a good new wine with perfect keeping properti it is advisable to mix the following varieties during vinification :

1) Red wine : — *Baco* 24-23 No. 1 and *Oberlin* 595 ; any of the oth red-wine bearers may be mixed, the more numerous they are, the bett will be the wine ;

2) White wine : — *Gaillard-Girerd* 157 and *Oberlim* 782 alone mal a complete wine ; *Baco* 22 A and 42-23, *Castel* 19002 (pink), *Couderc* 146-5 251-150, 272-60 are improved by being mixed as soon as they have left t press, and thus give a good table wine.

RESISTANCE TO PHYLLOXERA. — This was not studied directly by t author as his vineyard was in a district which is still immune. Neverth less, by reason of the information he has been able to obtain, he feels just fied in stating that ungrafted direct bearers may be planted in Ripar (i. e. light) soils, whereas in all others it is preferable to plant them grafte The hybrids *Oberlin* 595,663 and 782, *Baco* 24-32 No. 1 may be excepted o account of their great resistance.

RESISTANCE TO LIME. — In soils containing more than 15 % lime is wise to plant direct bearers on suitable stocks.

The following may be planted ungrafted :

1) *Oberlin* 595, 663, 782 ; *Baco* 24-23 No. 1, in all soils containing up to 70 % of lime *average harmfulness* ; 2) *Gaillard-Girerd* No. 2, all soils up to 25 % of this lime ; 3) *Cou* 272-60, J. 503, all soils up to 25 to 30 % of this lime ; 4) *Couderc* 146-51, all soils up to 15 this lime ; 5) *Baco* 22 A, 42-23 ; *Castel* 2 528, 3 343 ; 4 001 ; 8 930 ; 16 525, 19 002 ; *Cou* 106-51, 251-150, 28-112, 4 401 ; *Gaillard-Girerd* 157, 194 ; *Seibel* 128, 131, 156, 782, 86 1 000, 1 077, 2 004, 2 006, 2 010, 2 719, 2 743, 2 793, 2 828, 2 834, in all soils with a conte of *harmful lime* not exceeding 12 to 15 % ; 6) *Couderc* 7 103, 7 104, 7 106, insufficiently res tant to phylloxera and must always be used grafted.

Grafted direct bearers are *direct scions* ; they have a great affinity fo *americo-americans*, but most of them are do well with *franco-americans*.

II. — In 1916 the author noticed that some of his direct bearers, whic had hitherto proved interesting, did not give satisfaction for one or mor of the follwing reasons : insufficient resistance to mildew, oidium or ro mediocre or total absence of fertility. Among the bearers mentioned abo the following may be considered unsatisfactory :

1) White grape hybrid : — *Baco* 43-23.

2) Black-grape hybrid : — *Seibel* 117, 2703 ; *Couderc* 28-112.

RESISTANCE TO DROPPING. — 1) Total resistance :

White : *Baco* 22-A ; *Bertille Seyve* 150 ; *Couderc* 146-51, 251-150 ; *Seibel* 845, 2 875 — Bla *Baco* 24-23 No. 1 ; *Bertille-Seyve* 822, *Castel* 2 528, 3 001 ; *Couderc* 106-51, J. 503, 7 103, 7 7 120. *Hybride Fournié* ; *Seibel* 117, 121, 128, 131, 156, 782, 1 077, 2 004, 2 006, 2 010, 2 2 828, 4 576.

2) Dropping slightly :

White : *Castel* 19 002 (pink) ; *Gaillard-Girerd* 157. — Black : *Bertille-Seyve* 413, 151, 8 930 ; *Couderc* 7 106 ; *Seibel* 181, 2 620, 2 719, 2 834.

3) Clusters with two-thirds of normal fruit :

White : *Couderc* 272-60 ; *Seibel* 2 661. — Black : *Gaillard-Girerd* 19A ; *Oberlin* 595.

4) Clusters with equal numbers of normal and dropped fruit :

White : *Baco* 43-23 ; *Oberlin* 782 : *Seibel* 880. — Black : *Castel* 3 343 ; *Couderc* 4 401 ; *Gaillard-Girerd* No. 2.

5) Clusters with two-thirds of dropped fruit and one-third of normal uit :

Black : — *Castel* 16 525 ; *Seibel* 187, 735, 2 793.

6) All fruit dropping :

Black : — *Seibel* 802, 2828.

RESISTANCE TO OIDIUM : — 1) Immunity without treatment :

White : *Baco* 22 A ; *Bertille-Seyve* 450 ; *Castel* 19 602 (pink) ; *Gaillard-Girerd* 157 ; *Couderc* 251, 251-150, 272-60 ; *Oberlin* 782 ; *Seibel* 845, 880. — Black : *Baco* 24-23 No. 1 ; *Bertille-Seyve* 413, 453, 822 ; *Castel* 2 528, 4 001, 8 930, 16 525, *Couderc* J. 503, 106-51, 7 104, 7 106. *Hybride Fournié* ; *Gaillard-Girerd* 2, 194 ; *Oberlin* 595, 663 ; *Seibel* 117, 121, 128, 131, 156, 1, 187, 782, 1 077, 2 004, 2 006, 2 010, 2 620, 2 710, 2 734, 2 793, 2 834, 4 576.

2) Very slightly attacked :

Black : *Couderc* 4 401, 7 103, 7 120 : *Seibel* 735.

3) Slightly attacked :

White : *Baco* 43-23 ; *Seibel* 2 661. — Black : *Castel* 3 343.

RESISTANCE TO BOTRYTIS CINEREA. — All the direct bearers mentioned above as resistant to dropping and to oidium, are also totally resistant grey rot.

CONCLUSIONS : — The author states that the above facts concerning rect bearers apply in every respect to his vineyard, but that it is very ficult to adapt these vines to new surroundings, so that a grower, before opting direct bearers should test at least 10 of them in an experimental ot.

The Contribution of Forestry to the Problem of Public Nutrition during the War, in Germany. — BORGMANN, in *Tharandter Forstliches Jahrbuch*, Vol. 67, Pt. 6-7, pp. 367-386. Berlin, 1916.

The contribution of forestry to nutrition in war time has been developed on two different bases : 1) to furnish a plan by which the various problems relating to the desired end may be solved in order of their importance and urgency ; 2) while using the forests for the necessities of war to protect them as much as possible against excessive demands which would harm their permanent utility. These problems may be summed up as follows :

I. The gathering of fruit and mushrooms :

1) Products of plants growing near the earth : *a*) berries : — billberries, whortleberries, cranberries, marsh bilberries, strawberries, raspberries, blackberries ; *b*) mushrooms ; *Boletus edulis*, field mushroom, *Cantharellus cibarius*, *Agaricus virescens*, *Agaricus prunulus*, *Boletus*, *Agaricus ruber*, *Orchella esculenta*, etc.

2) Shrub fruit: sorb-apple, arbutus, barberry, hawthorn, sloe, wi
rose, juniper, medlar, cornel, etc.

II. The gathering of medicinal plants and tea substitutes.

III. The products of oil yielding trees:

1) The cultivation of colza in oak clearings, cultivation of sunflo
and poppy in the woods;

2) Harvest of beechnuts;

3) Harvest of other oil-yielding fruits: walnuts, hazelnuts, ho
chestnut, lime seeds and spruce seeds.

3) Potato to be replaced in the production of alcohol by wood a
by residuary waters containing sulphite from the manufacture of cellulo

VI. The use of wood and residuary waters containing sulphite from t
manufacture of cellulose in the production of alcohol.

VII. The use of wood residuary waters containing sulphite and t
leaves in the production of sugar.

VII. Grazing in the woods, the utilisation of grass and leaves, the
lisation of twigs as fodder.

VIII. Litter of dead leaves and peat.

IX. Cultivation of intercrops and peat-moss.

X. The killing of game, protection against the damage caused by gam
and the feeding of game in war-time.

Only a few of these problems have been solved; most of them are st
under consideration. A circular, dated June 27 th., 1916, concerning t
gathering of berries and mushrooms, has been issued by the President
the Food Control Department. Public institutes have also publish
illustrated instructions regarding the gathering of mushrooms, botanic
excursions have been arranged, exhibitions and information bure
opened, etc. In some districts the price of these products has risen so mu
that it is very desirable that they should be lowered. The encouragem
of the gathering of shrub-fruit has been left completely to local institut
This also applies to medicinal plants and tea substitutes (leaves of wo
Bramble, strawberry, raspberry, wild pansy, various species of *Vaccinia*
wild rose, willow, willow herb, elm, poplar, hawthorn, elder, cherry,
apple, maple, birch, etc.; flowers of lime, elder, camomile, etc.).

Of 1 093 436 acres of copse in Germany 642 486 acres are availa
for the cultivation of colza, and, of these, 86 488 acres could be used in
present season. All colza seed has been requisitioned and, in return,
cilities have been granted for obtaining colza cake. The author then g
details for the cultivation of colza. For the year 1916, about 4 942 a
were prepared, but no definite results will be obtained till harvest ti
The cultivation of sunflowers is still in the experimental phase, that
poppies can only be undertaken in good, well sheltered soils..

As regards the beechnut harvest, the following scheme has been dr
up:

Forest area of Germany	34 595 400 acres
Area under beech-woods	4 447 980 "
Area under nut-bearing beech, 1916	2 965 320 "
Area under nut-bearing beech over 100 years old	494 220 "
Area under beech available for use (50 % of the preceding area)	247 110 "
Yield in beech nuts from this area	491 071 tons
Oil yield	2 200 000 gallons
Cake produced	24 505 tons

The cost of oil production may be placed at about 3 *Marks* (3*s.* at par) r litre.

An order has been issued by the Federal Council and two circulars by e President of the Food Control Department concerning the utilisation l eechnuts as a foodstuff in war time in Germany and the occupied terri- ries. The author has published an appeal, and the war Committee for ls and Fats has distributed printed instructions on the subject.

There are few walnuts or hazelnuts in Germany. Horse-chestnuts ld about 5 % of oil, the utilisation of which is still being studied. Expe- ments showed lime seeds to give a yield of only 2.5 % on crushing, where- previous analyses gave their oil content as 18.25 % and even 58 %, ubtless extracted with the help of solvents. The oil yield of sorb-seeds also too low. Spruce seeds, on the other hand, give 25 % of oil. Experi- ents on the value of the cakes as cattle food are still in progress. How- er, if it is assumed that there are 6 177 750 acres of spruce in Germany, d that, 49 422 acres are felled annually, calculating 68 bushels of cones r acre there would be a yield of 55 020 bushels of cones, to which ust be added 687 750 from the harvest from standing trees. Reckon- g that 1.2 lbs. of seed are obtained per bushel of cones, there will be a ld of 393 tons of seed giving 98 tons of oil at 5.40 *Marks* (1) per litre.

If the greater part of the beechnuts is used for oil production and cakes, orns and horse-chestnuts are left for use as cattle food. The use of these as been regulated by a federal order and their sale is controlled by the Sa- s Union of German Farmers. The price fixed is 190 Marks per ton for ried acorns and 150 Marks per ton for dried horse-chestnuts. It would e possible to extract oil from the horse-chestnuts for the manufacture of akes. The War Food Bureau has issued an appeal for the harvest of these o products.

The production of wood meal as a foodstuff will soon be realised. A actory for this purpose is connected with the eastern army headquarters t Souvalki; there are two factories using STEFFEN'S method, and another ing built which will use WINTHEIM, TEN DORKAAT and CLASSEN'S method. he War Committee for Cattle Food Substitutes controls the use of this ial.

The use of meal made from heather, dried and freed from its woody rts, and also lichen (*Cetraria islandica* and *Cladonia rangiferina*), has been

(1) 1 Mark = 1 *s.* at par. (*Ed.*)

proposed. The former has a value equal to that of average hay; the latter may also be used for human nutrition.

The progress made in the utilisation of wood and sulphite-containing residuary waters from the manufacture of cellulose has allowed a large quantity of potatoes to be freed for human and animal nutrition. It has also been proposed to use the sulphite-containing residuary waters as animal foodstuff. These waters may also be used for the commercial production of sweetened solutions, and, in the same way as infusions of tree-leaves for the production of fat and albumin by means of cultures of *Endomyces vernalis*.

It is advisable to enclose wood pasture-land. Though the use of grass and leaves as fodder has been considered by the Federal Council and by the author, there is, for the moment, no need to use twigs as fodder.

Dead leaves and peat may be used as litter. The growing of cereals, especially rye, maize and broad beans, as intercrops in the woods is under consideration. The cultivation of the peat-beds has been intensified with the help of prisoners of war.

The most satisfactory way of preventing damage by game is to kill it. This, however, must be restricted so that the number of game in the wood shall not be unduly limited, as, in this case, the loss would exceed the gains. Game represents 0.5 % of the meat supply, and, even if it were all killed, this figure would only be increased two or three times. Nevertheless, an order of the Federal Council has fixed maximum prices for game and another allows the netting of thrushes. The importance of not neglecting the feeding of game, even in war time, is insisted on, so that the source of food may be maintained. In order to keep the game healthy, mixed foods should be supplied at the beginning of winter. Five groups of food are recommended for this purpose.

LIVE STOCK AND BREEDING.

733 - **Notes on Some Animal Parasites in British Guiana.** — BODKIN, G. E. and CHRISTY, L. D., in the *Bulletin of Entomological Research*, Vol. VII, Pt. II, pp. 179-[illegible], 1 plate. London, October, 1916.

The following species are noted and a short description of each given:

VERMES.

1) NEMATODA: *a)* FILARIDAE: *Filaria cervina*, Duj. on a cow; *F. physalura*. Breed on a large bird of common occurrence, the Collared Kingfisher (*Ceryle torquata*); *F. inermis* Leidy, very common on creole dogs, who do not seem to suffer from it, or only to a very slight extent, the mosquito (*Culex fatigans*) is probably the propagator of this parasite. *F.* sp. ? White-breasted Swallow (*Tachycineta albiventris*).

b) ASCARIDAE: *Ascaris megalocephala*, Cloquet, on a horse.

c) STONGYLIDAE: *Ankylostoma* sp., on dogs; *Physaloptera? praeputialis*, Linst. cats.

2) PLATYHELMINTHES: *Dicorcelium* sp., very common on cats.

3) CESTODA: *Moniezia expansa*, Rud, on pigs.

4) ACANTHOCEPHALA: *Echinorynchus gigas*, Goeze, on pigs.

ARACHNIDA.

[illegible]CARINI: **IXODIDAE**: In British Guiana all kinds of live stock are attacked by various [illegible]s of ticks, which are in many cases responsible for a very considerable annual financial [illegible] The animals are not dipped, nor are any other preventive measures taken. *Argas per-* [illegible] Wald., in fowl-houses, *Rhipicephalus sanguineus*, Latr. found in all its stages of develop- [illegible] on dogs; *Margaropus annulatus*, var. *australis*, Fuller, on all cattle; *Amblyomma cajen-* [illegible] F., a parasite of man; *A. humerale* Koch, on turtels; *A. dissimile*, Koch, a common para- [illegible] the ordinary toad (*Bufo marinus*), and sometimes found on lizards and snakes.

HEXAPODA.

[illegible]DIPTERA: *a)* **TABANIDAE**: In the coastal region Tabanidae occur frequently, usually [illegible] numbers of a few common species. In the forest area, however, the coast-land species [illegible] occur, but there are many others, some of which are comparatively rare. The savan- [illegible] near the Brazilian border are particularly rich in Tabanidae, but this district has not [illegible] closely investigated. The most common species which attack live-stock on the coas- [illegible]: *Tabanus trilineatus*, Latr., possibly the commonest and most widely distributed [illegible] found in forest regions); it does not attack man and is attracted by artificial "light"; [illegible], Wlk.; *T. semisordidus* Wlk.; *T. trifasciata*, Wlk.; *T. desertus*, Wlk.

[illegible] *senior*, Wlk. and *T. semisordidus*, Wlk. are much alike in appearance and habits; [illegible] all kinds of stock but have never been observed to attack human beings. *T. impres-* [illegible] is widely distributed and has been known to attack man. It has been impossible [illegible] the feeding habits of *T. desertus*, Wlk. *T. cayennensis*, T., is a parasite of stock oc- [illegible] found near the coast; it is common in some of the interior districts and readily at- [illegible] *T. leucaspis*, Wied. occurs rarely within the forest area, where it has been observed [illegible] man. *T. ochroleucus*, Mg. is attracted to houses by artificial light and attacks man. [illegible] of *T. oculus* Wlk. was taken in the interior districts while attacking man.

[illegible] *cerus*, Wied., is not uncommon in some of the interior districts and readily [illegible]

[illegible] *tristis*, T., is widely distributed round the coast and occasionally found in the [illegible] *costata*, F., only met with in certain districts where the soil is of a sandy na- [illegible] at large stretches of fresh water; like *C. tristis* it attacks man. *C. fulviceps*, Wlk. [illegible] found in the forest districts only. Specimens of *Bolbodimyia bicolor*, Big. and [illegible] F. were taken while attacking man.

[illegible] certain times of the year *Dichelacera scutellata*, Macq., *D. pedagricus*, F., and *D. curvipes*, [illegible] extremely abundant and most obnoxious owing to their persistent attacks on man. [illegible] inhabit the forest regions, especially those near the rivers in the north-west district. [illegible] *lamicornis*, F. and *D. testacea*, Macq. are found in the forest districts and [illegible] attack man.

[illegible] chief enemies of Tabanidae are large wasps of the Bembecinae family. The common- [illegible] of those found on the coast are: *Monedula signata*, Latr., *M. punctata*, Lep. and [illegible], Dahlb., while, in the forest region, *M. pantherina*, Handl. is common. In this [illegible], *Bembidula discisa*, Tasch. and *B. variegata*, Oliv. are also found. The Asilid fly [illegible] F. is also an occasional enemy of Tabanidae in the coastal area.

[illegible] outbreak of *Trypanosoma equinum* ("Mal de Caderas") amongst sugar plantation [illegible] was most probably propagated by biting flies, for most of the common species of Taban- [illegible] other biting flies, such as *Stomoxys calcitrans*, L. were observed on the diseased [illegible] *calcitrans* is common in the coastal area and in many of the inhabited inland regions. [illegible] absence of other hosts it readily attacks human beings.

[illegible] ANTHOMYIDAE — *Mydaea pici*, Macq., whose larvae are subcutanous parasites of [illegible]

c) MUSCIDAE. — *Stomoxys calcitrans*, L. L. (see above).

d) HIPPOBOSCIDAE. — A large number of these are known to attack birds; among them *Lynchia maura*, Big. is common on domestic pigeons.

2) SIPHONAPTERA: *a*) SARCOPSYLLIDAE: *Dermatophilus penetrans*, L. is widely distributed throughout the colony.

b) PULICIDAE: *Ctenocephalus felis*, Bch., very common on cats and dogs and occasionally attacks man.

3) RHYNCOTA. — CIMICIDAE: *Cimex hemipterus*, F. (*rotundatus*, Sign.)

4) ANOPLURA. — *a*) PEDICULIDAE: *Pediculus capitis*, de Geer; *P. humanus*; *Phthirus pubis* L.

b) HAEMATOPINIDAE: *Haematopinus eurysternus*, Nitzsch., is the common ox louse; *H. tuberculatus*, Nitzsch., found only on imported Indian buffaloes; *H. suis*, L. very common on pigs.

5) MALLOPHAGA: *a*) TRICHODECTIDAE: *Trichodectes pilosus*, Gieb., on the dog; *T. climax*., N., on the goat; *T. sphaerocephalum*, N., on sheep.

b) PHILOPTERIDAE: *Philopterus breviformis*, Kell. and Kuw.; *Ph. ducalis* Piag; *Ph. obscurus* Gieb; *Degeeriella* sp.; *Paragoniocotes abnormis*, Kell.; all parasites various species of birds.

c) GONIODIDAE: *Goniocotes curtus*, N., on a species of pheasant; *G. gigas*, Nitz. (= *abdominalis*, P.), on chickens and turkeys; *G. hologaster* N., on pigeons and guinea-pigs; *G. dissimilis* N., on chickens and turkeys; *G. compar*, N., on pigeons; *G. pavonis*, L., on the peacock; *G. stylifer*, N. on turkeys.

d) LIPEURIDAE. — *Lipeurus assessor*, Gieb.; *L. baculus*, N., *L. leucofygus*, N., *L. trapezius*, N.; *L. squalidus*, N.; *L. variabilis*, N.; on various species of birds, domestic otherwise

e) MENOPONIDAE: *Menacanthus* spp.; *Menopon biseriatum*, P.; *M. pallidum* N. *macropus*, Gieb; *Myrsidea rustica*, N.; *Colpocephalum dissimile*, Piag.; *C. maculatum* N. *C. phaeostomum*, N.; 3 other undetermined species of *Colpocephalum*, parasites on various species of wild and domestic birds.

f) PHYSOSTOMIDAE: *Physostomum angulatum*, Kell. and *Ph. sp.* on birds.

3) LAEMOBOTHRIDAE: *Laemobothrium epistbocomi*, Cummings and *L.* sp., on birds.

h) GYROPIDAE: *Gyropus ovalis*, N. and *Gliricola gracilis*, N.; on guinea-pigs.

734 – **Mercury Compounds in the Treatment of Epizootic Lymphangitis** (1).

GUIDO, in *Bulletin de la Société de Pathologie exotique*, Vol. X, No 6, pp. 428 [illegible] June, 1917.

In January 1916, the author, having 5 horses in his stables suffering from a very serious form of epizootic lymphangitis, made a test of the value of a new method of treatment which gave perfectly satisfactory results.

G. GASPARINI had previously recorded a case of cure of a horse which was suffering from a serious form of epizootic lymphangitis, effected with bichloride of mercury employed in the same way as in syphilis.

The presen writer has experimented with this and with other forms of mercury treatment:

a) Salicylate of mercury	6 gr.
Sterilised vaseline oil	100 "
b) Calomel	5 gr.
Sterilised vaseline oil	100 "
c) Bichloride of mercury	1 gr.
Sodium chloride	2 "
Boiled distilled water	100 "

(1) See *B.* June 1917, No. 561.

Finally, he has tried a fourth formula *d*) an arsenious-mercuric associa-n, based on the results obtained in certain infectious diseases with a mixed atment :

d) Benzoate of mercury	1 gr.
Sodium chloride	0.26 "
Cacodilic acid	0.50 "
Boiled distilled water	100 "

The two first solutions were injected endomuscularly and the remain-two both hypodermically and endomuscularly.

With the last formula two horses have been treated and cured.

The treatment, as is usually with all mercuric treatments, should be plied with care. If signs of mercuric poisoning occur, the treatment st be suspended, oil purgatives administered and treatment recommenced o to days later, or, if there has been kidney trouble, as soon as albumen disappeared from the urine.

The animals were cured after 10 to 12 injections.

The writer considers himself justified in stating that mercurial treat-nts for epizootic lymphangitis are the best, both from the economic point view and from the point of view of result.

The cure was complete and no relapse has been observed in any case.

Formulae *c*) and *d*) gave the quickest cures.

5 - **Ulcerative Stomatitis in Horses.** — RENE, CH., in *Le Progrès agricole*, 31st. year, N. 1557, p. 311. Amiens, July 1, 1917.

Ulcerative stomatitis has practically only been recorded in France on my horses, but owing to its great contagiousness is quite capable of spread-g to other horses. It seems to have been introduced from abroad.

The symptoms of this complaint are very similar to those of thrush cattle, although the two diseases are distinct : profuse saliva and diffi-ty in chewing at the beginning ; lesions of the membranes of lips, mouth tongue ; in places the mucous membranes seem to be covered with a sty exudate of an inflammatory nature ; small sores round the lips and ly on the tongue as well (often an ulcer as big as the palm of the hand pears upon the tongue) : in short, lesions, confluent or otherwise, re-mbling those of the mouth cavity of cattle suffering from thrush.

Contrary to what takes place in thrush, no lesions have been recorded on the foot region, the disease does not touch ruminants nor pigs and ap-ars to be a local complaint, taking its course without causing fever.

The cause of the complaint is not yet known : it has been attributed to e irritant or toxic action of certain fodder plants but this has not been finitely established.

Ulcerative stomatitis is extremely contagious and is spread by horses nking from a common trough, being stabled together etc.

The infection is not serious ; it requires about 10 days to run its course. he lesions remain localised and the damaged consists in the affected ani-als losing flesh owing to difficulty in chewing and swallowing.

Treatment: liberal washing out of the mouth cavity with water containing honey and vinegar or slightly salt, or with weak solutions of potassium permanganate (1 gr. per 20 litres of water; feeding with bran or flour mashes or young grass; isolation of the sick horses; each horse should have its own recipient for water and food. It might be advisable at times to effect voluntary contamination.

736 - **Rabies and Haemorragic Septicaemia in some Young Buffaloes, in Italy.** MORI, NELLO, in *La Clinica Veterinaria*, Year XL, No. 7, pp. 177-191; No. 8, pp. [illegible] Milan, April 15 and 30, 1917.

In December 1910 and January 1911, a group of young buffaloes (six) separate from the adult males and only brought to the mothers to suck, of the Aversano farm, in the commune of Battipaglia (Salerno), were found to be suffering from a disease, whose symptoms related almost exclusively to the nervous system, and which had not been previously observed in that region. Four young buffaloes died of the disease. Some days previously the stockmen had killed two dogs showing signs of hydrophobia.

The two last young buffaloes that died showed no anatomical lesions under the autopsy that were worthy of note; their heads were sent to the writer to diagnose the disease. The examination was carried out at the Experimental Station for infectious diseases of cattle at Portici (Naples).

By inoculating a series of rabbits, it was established that the cause of death was rabies, a disease not previously recorded for the buffalo. The incubation period for rabies in the buffalo was not established.

The observed symptoms, although similar to those of cattle rabies, do not appear to be referable to hydrophobia virus, as they could be reproduced experimentally by inoculating the toxins obtained from the blood of buffaloes or rabbits, or produced in cultures *in vitro* of the pathogenic organism isolated from the brain of the buffaloes, or from cultures of the typical *Bacillus bubalisepticus*, although in this case the effects were less serious. It appears that, in the buffaloes in question, the virulence of the disease had been checked by an infection due to *B. bubalisepticus*. The secondary infection by this organism does not seem strange in a disease caused by a filterable virus; since in another disease caused by this virus (strangles, swine fever, equine influenza, etc.) secondary invasions by organisms causing haemorragic septicaemia are seen. On the other hand, it appears new in relation to the virus of rabies. As is well known, *B. bubalisepticus* is fairly common on buffalo breeding farms and is found in the latent state in the digestive tracts of these animals. In the case in question, the virus of rabies, besides preparing the way for the invasion of *B. bubalisepticus*, would have overcome the resistance to the above complaint presented by young buffaloes during the period of feeding by the mother, possibly through temporary immunisation conferred by the mother's milk. All the mothers have certainly contracted *bubalisepticus* enteritis, the disease appearing to confer immunity for the rest of the life.

Although the buffalo calves had sucked during the disease, there were no cases of transmission of rabies to the mothers or other calves.

pears to be due to the fact that the rabies was checked in its progress ore the saliva could have become virulent.

- Studies on Contagious Agalaxy of Goats in Algeria. — SERGENT, EDM, and ROIG, G., in *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 7, pp. 575-585. Paris, July 11, 1917.

The work was carried out at the Pasteur Institute of Algeria.

On the 28th. April, 1908, the author was called in to examine, in the ighbourhood of Algiers, a herd of about 450 goats, of which, in a week, ent 60 mothers and a few he-goats had been attacked by contagious aga-y. Three or four kids died each day. On July 15th., 19 goats and 105 ls died. Ten years ago another case of agalaxy among goats was noticed BANGUIL, formerly head of the Algerian Veterinary Sanitary Service, in Guergour and Kerrata districts. It is certain that these epidemics are frequent as, for ten years, the author has been unable to trace any others, d veterinary delegates state they have never seen one in Algeria.

During the infection of 1908 there was always present in the pure milk ent rium, cultures of which produced no symptoms of the disease when culated. It was thus a proof of the invisible specific virus discovered CELLI and DE BIASI in 1906. In its characteristics this micro-organism olated to PREISZ NOCARD's heterogenous group. Bacteria of the ne group are found in various serious diseases of sheep. Their patho-nic action is not clear.

DESCRIPTION OF THE EPIDEMIC : 1) *Effect on kids* : almost complete loss appetite, limbs drawn in under the body ; head slightly stretched for-rd ; hair almost bristling ; sometimes the kid falls in convulsions ; death ually occurs on the 2nd, 3rd. or 4th. day ; the temperature rarely exceeds °C. Sometimes during the development of the symptoms the animals go badly. Post mortem results always negative.

2) *Effect on adults.* They are affected much less than the kids. e general symptoms are more vague ; the disease always appears in its onic form. There is gradual loss of appetite ; temperature varies be-en 38.0° and 39.2°C.

The lesions always appear on the udder ; sometimes the udder and one re are attacked simultaneously. The udder becomes inflamed ; milk retion decreases ; the milk on standing separates into two distinct parts ; e lower part ($^1/_3$ or $^1/_2$, sometimes $^2/_3$ of the volume) is formed of a dirty hite deposit ; the upper part (usually $^2/_3$ of the volume) is dirty white, metimes reddish. The milk gives an alkaline reaction, coagulates at °C. and, at the same temperature, coagulates normal milk ; it keeps these operties after being passed through a CHAMBERLAND F. filter. After out 15 days, milk secretion stops completely. Abortion sometimes curs. Post mortem examinations give negative results.

EXPERIMENTAL STUDY. — Attempts were made to reproduce the di-se in goats experimentally by : 1) inoculation of milk (in the udder, peri-neum, subcutaneously) ; 2) ingestion of milk ; 3) blood inoculation ; infection through contact. Guinea-pigs and rats were also inoculated ith the milk.

The results led to the following conclusions :

CONCLUSIONS . — The Algerian epidemic of 1908 was remarkable for its suddenness and violence. In 3 months it killed 124 goats out of [illegible] (27.5 %), especially attacking young animals.

In the natural disease, mammary lesions always occur, lesions of the joints frequently occur, lesions of the eye have never been observed. In milking animals, therefore, only show lesions of the joints.

In the experimental disease, lesion of the udder and joints are always present ; lesions of the eye have been noticed in 2 cases out of 13.

The disease was not transmitted by inoculation of the blood of infected animals ; vaccination did not confer immunity.

Inoculation with the milk (subcutaneously or in the peritoneum) produces the disease in goats without fail. Intraperitoneal inoculation does not affect either the guinea-pig or the rat.

The virus is not weakened by passage through the body.

The ingestion of infected milk does not give the disease.

One goat was infected by contact.

In the epidemic studied a polymorphous bacterium of the PREIS NOCARD group was always found in the milk, never in the blood.

Inoculation with cultures of this microorganism was not pathogenic.

This bacterium is doubtless a proof of the invisible virus discovered by CELLI and DANTE DE BLASI. It does not even appear to play the part filled by CARRÉ'S pyobacillus in Lutz's disease. It simply appears to prove that the infection is caused by the specific virus.

738 - **Studies in Milk Secretion.** — HAMMOND, J. and HAWK, J. C. (*School of Agriculture, Cambridge*) in *The Journal of Agricultural Science*, Vol. VIII, Part 2. — I. The Effect of Nutrition on Yield and Composition, pp. 130-146, 3 tables, 2 figs. — II. The Relation of the Glands of Internal Secretion to Milk Production, pp. 147-153, 5 tables.

I. — No definite principles have yet been established with regard to the effect of nourishment on milk production, notwithstanding the quantity of work done on this subject. The object of the present writers was to study the changes in the yield and composition of the milk which follow a sudden change in nutrition. These changes were effected by the administration of phloridzin together with the control of the food supply.

Well fed goats were used in all the experiments and care was taken that they had continual access to an abundant supply of water. They were milked regularly at different intervals three times a day ; records were kept of the yield at each milking in cc. and the percentage fat in each milk was estimated by the GERBER method.

Three series of experiments were performed : *a*) food was withheld for a short time and then a plentiful supply given ; *b*) food was withheld, phloridzin (in alcohol) was injected and shortly afterwards a plentiful supply of food given ; *c*) phloridzin was injected into goats under perfectly normal conditions of feeding.

The results of the experiments were as follows :

As a result of withholding food for a few days, together with an injection of phloridzin, thereby reducing the nutrition, the daily yield of milk

goats was diminished and in one case the flow was actually stopped. giving food again the yield returned almost to normal within a few days.

As the daily yield of milk diminished under these conditions so percentage of fat in the milk rose. Limitation of the available nutrint in the body (change from a high to low state of nutrition) did not re- the percentage of lactose or protein in the milk (PATON and CATHCART) t reduced the quantity of milk (together with the amounts of protein, gar and salts) produced. The secretion of fat was not at first affected the change in metablism and as a consequence milk rich in fat was pro- ed.

The amount of fat secreted per day under these conditions of diminishing yield was, however, not constant but became reduced, possibly as condary effect of the decreased secretion taking place in the gland cells. On again giving food to animals in such a reduced state of nutrition, percentage of fat in the milk decreased as the yield increased, in some s to such an extent that it was below that of the normal milk before the eriment began.

II. — It is now generally recognised that the glands of internal secre- play an important part in regulating the metabolism and so controlling nutrition of the animal. The present experiments with pituitary ex- and adrenalin were devised in order to test the relation of the glands internal secretion to milk production.

Pituitary Extract. — The effect of pituitary extract was studied in anils under conditions of reduced nutrition, the conditions of the experiits being exactly as described in the first paper; see (*a*), (*b*) and (*c*) ve. It is known from previous experiments that under normal nitions injections at intervals of one day give no immunizing effect, ections of 1 cc. at such intervals giving approximately the same amount milk. The goats were milked dry each morning and immediately after of pituitary extract was injected. Since it has also been shown that action of the extract was complete in less than half an hour after inion, the goats were milked after this period, and the amount obtained taken as the yield resulting from pituitary injection. The percentage fat in each sample was determined by GERBER's method. The following nclusions were reached:

The flow of milk produced as a result of an injection of pituitary exact varies with the state of nutrition of the injected animal.

This variation (due to nutrition) is not so great as that produced in case of the morning or the daily yields, indicating that the action of the itary extract is on some more stable quantity (possibly some special re situated in the ducts and alveoli of the mammary gland).

The percentage fat of the pituitary milk is increased by the state of ced nutrition in the same way as that of normal milk:

Adrenalin. — The goats (three) were milked at definite times twice day but in addition to this, injections of, on the average, 6 cc. of a $^1/_{1000}$ lution of adrenalin chloride were made on alternate days after the morning lking, the goats being milked again at an interval of half an hour. On

the "normal" days, which alternated with the days on which adrenalin was given, the treatment was exactly the same except that sterilised water was injected in the place of adrenalin. It was so arranged that the day for the purpose of computing the yield, started with an injection. The following table gives the average for all these experiments.

	cc. milk (12 days av.)		% fat. (6 days av.)		gm. fat. (6 days av.)	
	Adrenalin	Normal	Adrenalin	Normal	Adrenalin	Normal
Injection. . . .	19	20	7.9	7.6	1.5	1.5
Evening	122	172	5.5	5.2	6.7	9
Morning	388	452	4.1	3.5	16.3	15.8
Total	527	643	4.6	4.0	24.5	25.3

The following are the conclusions:

Injections of adrenalin though resembling pituitary extract in causing hyperglycaemia differ from them in having no immediate action on milk secretion.

Injections of adrenalin have a secondary effect on milk secretion causing a decrease in the amount of milk produced for a period of a day following its injection.

The percentage of fat in the milk from the period following an injection of adrenalin is above normal, although the actual amount obtained is somewhat below normal.

The rate of the milk flow is very susceptible to changes in the metabolism of the animal.

739 – **The By-Products of the Decortication of Rice ("pula vergine") as a Substitute for Wheat in Feeding Horses.** — GIULIANI, R., in *Minerva Agraria*, Year 9, No. 2, pp. 98-103. Milan, May 15-31, 1917.

As a continuation of his experiments on the use of the by-products of the decortication of rice in the feeding of dairy cows (1) the author carried out a feeding test on 10 horses, 5 experimental and 5 control, in order to determine: 1) if horses accept these by-products willingly and how they should be given; 2) if these by-products may be substituted for oats without reducing the live weight and working capacity of the horses; 3) to what extent such a substitution is advisable; 4) the economic advantage of such substitution; 5) the method of preserving these by-products.

The experiment lasted 66 days, including a preparatory period of 6 days during which the horses were accustomed to the by-products, and periods of 12 days each, varied by a progressive increase in by-products and decrease in oats.

The experiment was made with by-products obtained by the blanching and polishing of rice, with oats and with hay. The chemical composition of the feeding-stuff was as follows:

(1) See *B.* January 1917, No. 56.

TABLE I. — *Chemical Composition of the Food Stuffs Used.*

	By-products of Rice	Oats	Hay
Moisture	15.60 %	12.55 %	11.60 %
Crude protein	11.55	9.95	6.55
Crude fat	13.60	4.50	2.05
Fibre	9.00	9.35	21.75
Nitrogen-free extract	40.10	60.55	51.34
Ash	10.15	3.10	6.76
Digestible protein	8.99	9.00	4.25

The determination of digestibility (by KELLNER's tables) and the food lue, expressed in kilograms (1) of starch, of one quintal of by-products rice, of oats, and of hay, showed that, theoretically, 1 kg. of oats equals food value 0.931 kg. of rice by-products. In order to make the sub- itution more practical, it was assumed that 1 kg. of oats corresponds 1 kg. of rice by-products.

Before the experiment the horses received 3.5 kg. of hay, 4.2 kg. oats and 1.2 kg. of straw. This ration was also fed to the 5 control imals. The experimental horses received successively in the 5 periods spectively 1, 1.5, 2, 2.5 and 3 kg. of rice by-products, 3.2, 2.7, 2.2, 1.7 d 1.2 kg. of oats, and invariably 3.5 kg. of hay and 1.2 kg. of straw like the ntrol horses.

An examination of the total weight of the control group and the ex- rimental group at the beginning and at the end of the experiment showed increase of 49 kg. for the first group and of 59 kg. for the second. No ference was observed in the energy, temper, sweating, etc. of the horses the two groups. No definite results could be obtained concerning the sistance to fatigue because the work done by the animals (2 hours' exer- se per day) was modified throughout the experiment.

The results of the experiment led to the following conclusions :

1) The by-products of the decortication of rice are willingly accepted horses, and it is best to give them mixed with oats or in the form of cake.

2) These by-products have no bad influence on the health of the rses.

3) About $^2/_3$ by weight of the wheat ration may be substituted by the products without prejudice to the live weight, the energy and the tem- r of the horses.

4) Such a substitution is a real economic advantage (0.45 fr. per y per horse).

5) The by-products should be kept in a dry place in layers about 11 to inches thick and turned over from time to time.

(1) 1 Kilogram = 2.20 lbs. (*Ed.*)

740 - **Feeding Trials with Cattle at the Model Farm of Dikopshof, Germany.** — Ro
ARDSEN, A., in *Landwirtschaftliche Jahrbücher*, Vol. 49, Parts 3-4. Berlin, 1916

I. — Calf raising.

Trials in order to determine whether the feeding stuff «cerealis» (1) is capable of replacing (either wholly or in part) whole milk in raising calves.

About 30 calves received the feeding stuff in question over a period of 5 months. A number of difficulties were encountered in the course of the trials and the results were not very decisive. However, they have shown that «cerealis» is better adapted to calves than to young pigs. The trials ought to be repeated.

II. — Winter Feeding of Heifers.

Four trials conducted with animals from 1 ½ to 2 years, in order to determine whether it is profitable to dispense with hay in the winter feeding of heifers intended for breeding purposes; the writer describes three of these trials.

The 5 animals belonging to the first test were brought in from grass on October 26, and received the following daily ration per head:

From October 26 to November 7: Oat straw 5 kg. — Ground-nut cake, 1 kg. — Mangolds 10 kg.

From November 7 to December 9: Same ration + 5 kg. of roots.

From December 9 to April 10 (end of trial), same ration as at start.

The rations were always well accepted.

During the period of the trial, the live weight increase was 60 kg. or 416 gr. daily increase per head. The winter feeding cost in round figures 68 *Marks* (2) per head.

In the next trial, with 10 heifers, the beasts were brought into the stable on November 18. The ration was as follows: *Group* I: Oat straw, 5 kg. Ground-nut cake, 0.5 kg. — Mangolds 10 kg. In January and March the mangel ration was replaced by an equivalent amount of leaves and heads of sugar beets. The trial terminated on April 1.

The increase in live weight was 448 gr. daily per head for group I and 414 gr. for group II. The difference between the groups is consequently small, but a bigger ration of concentrates gives a corresponding increase in live weight. The winter feeding cost, according to whether 1 kg. or 0.5 kg. of cake was fed, 54 *Marks* and 42 *Marks* per head respectively.

The nutritive value of the ration administered being considerably below that given by Kellner for young cattle, the writer concludes that heifers can be wintered all right on this ration provided they get sufficient to eat the following summer.

(1) See *B.* July 1917, N° 652.

(2) For the purpose of this article 1 Mark may be regarded as equivalent to 1 shilling.

From April 1 till October 1, the heifers were at grass and development was perfectly normal.

The 19 beasts of the 3rd trial were divided into 4 groups. The daily ration per head was as follows.

Groups I and II : Oat straw, 4 to 5 kg. — Ground-nut cake (ground), 0.5 kg. — Dried mangold leaves 2.5 kg.

Group III : Oat straw, 5 kg. — ground-nut cake (ground), 0.25 kg. — Dried mangold leaves 2.5 kg.

Group IV : Oat straw, 5 kg. — Dried mangold leaves, 2.5 kg.

The trial, which was begun at the beginning of December for the two first groups and at the end of the same month for the two last ended on March 24. At the beginning of the trial the heifers of groups I and II were 10 to 12 months old and those of groups III and IV 16 months.

In the course of the trial the live weight of the heifers of groups I and II showed a slight increase while that of the animals in groups III and IV showed no change. There is nothing surprising in this as the rations contained the minimum necessary for maintenance.

After the conclusion of the experiment the animals were put to grass and developed normally.

On the basis of these experiments the writer has evolved the following rations for feeding heifers through the winter without recourse to hay. Provided the animals get sufficient to eat when wintering is over their later development cannot be harmed by these rations.

Winter Feeding of Heifers without Hay.

Age of heifers at beginning of winter	Concentrates (if possible cakes rich in albuminoids or crushed pulses)	Straw (if possible good oat straw)	Green or dry fodder	
			Healthy roots rich in nutriment	Mangold leaves dried 1st quality
1½ year	0.50 kg.	4 kg.	8 kg.	1.6 kg.
1½ "	0.25 "	5 "	10 "	2 "
1½ years	— "	6 "	12 "	2.4 "

Each animal should receive as well a dose of salt and 20 gr. of assimilable lime.

III. — Feeding of Milch Cows

Careful experiments lasting over a fortnight, the first week being regarded as a preliminary test and the second as the real experiment.

In addition to the basal ration and food under trial each animal received daily 30 gr. of kitchen salt and 30 gr. of assimilable lime.

Dry yeast, sesame cake and maize gluten flour compared with ground nut cake — In the first trial, from February 12 to May 2, with 12 cows in full milk, the

basal ration contained, per 1000 kg of live weight, daily : Meadow hay, 10 kg. — Mangolds, 40 kg. — Slices of sugar beet, 4 kg. Its starch value was 8.5 kg. Four kilos of each trial food were administered. The starch value of the whole ration was 14.7 kg., the quantity of digestible albumen 2.813 to 3.059 kg.

In the 2nd. trial with 13 cows (of which 4 were eliminated before the end of the trial), the basal ration contained, per 1000 kg. of live weight : Meadow hay, 10 kg. — Mangolds, 40 kg. — Slices of sugar beet, 4 kg. The trial food was administered at the rate of 4 kg. daily per 1000 kg. of live weight.

The two trials gave nearly the same result for the sesame cake and the maize gluten flour but different results were obtained with yeasts. The yield of milk, indeed, was slightly diminished by the yeast, slightly increased by the maize-gluten flour and was unaffected by sesame cake. The fat content was unaffected by the yeast, but slightly decreased by the sesame cake and maize-gluten flour ; the former of these two last feeds gave the smallest fat content. The dry matter was influenced in the same way as the milk yield.

In conclusion, dry yeast, sesame cake and maize-gluten flour are not in normal times a very good feed for dairy cattle, but their use may still be recommended. More than 2 to 3 kg. daily per 1000 kg. of live weight should not be given however.

Leaves of sugar beet dried and ensiled compared with hay and mangolds. — The basal ration in the first two trials was composed of : 40 kg. of mangolds — 2 to 4 kg. of sugar beet slices — 3 to kg. of palm-nut cake — 1 to 2 kg. of wheat bran — 3.4 to 3.8 kg. of ground-nut cake. To this the writer added about 10 kg. of hay, 8 kg. of dried mangold leaves, 40 kg. of ensiled leaves. Starch value of the complete ration : 14 kg. daily per 1000 kg. of live weight. Number of cows : 11. Duration of trials, from Dec. 2 to April 22.

In two other trials, from January 11 to April 20, with 7 and 10 cows respectively, one or other of the following feeds was administered daily per 1000 kg. of live weight in addition to the basal ration : Mangolds 40 and 60 kg. — Ensiled leaves of mangold, 40 and 60 kg. — Dried leaves of mangold, 8 and 12 kg. Starch value of the whole ration, 14 kg. Digestible albumen content, 2.483 to 2.724 kg.

According to the 4 trials, the dried leaves have given better results than the ensiled leaves as far as milk yield is concerned. With regard to the fat content, however, the ensiled leaves gave the bigger yield. The figures for the dry extract and the dry extract devoid of fat were modified in the same way as those relating to the milk yield. Generally speaking the yield of fat is increased to a greater extent than the yield of milk. On those farms where great importance is attached to the fat content, hay and mangolds may well be replaced by dried and ensiled leaves of mangold, provided the remainder of the ration is properly constituted.

The writer recommends, however, not to give more than 50 kg.

illed leaves and more than 10 kg. of dried leaves per 1000 kg. of live ight daily.

Cacao and locust pods compared with barley. — The 12 milch-cows re- ed daily per 1000 kg. of live weight, a ration basal composed as follows: ow hay, 10 kg. — Mangolds, 40 kg. — Sugar beet slices, 3 kg. In ition they also received: about 4 kg. of barley, 4 kg. of cacao pods, g. of locust pods.

Starch-value of the ration: 14 kg.; digestible albumen: 2.5 to 2.7 kg. ration. Duration of trial: Dec. 30 to Feb. 23.

The milk yield was greatly diminished by the cacao pods, but was prac- lly unaffected by the locust pods. Taking the milk yield produced on as 100, the figure for the cacao pods is 85 and that for locusts 98.5. fat content was greatly increased by the cacao pods and unaffected by locusts.

The cacao pods are, consequently, not adapted to farms which attach ticular importance to the quantity of milk while somewhat neglecting fat content. The locust is a neutral feed capable of replacing other ds rich in carbohydrates but poor in albumen.

I. Feeding Cottonseed Meal and Hulls to Dairy Cows. — II. Feeding Value of Cottonseed Meal vs. Cold Pressed Cottonseed Cake. — III. Feeding Value of Purchased Feeds vs. Pasture vs. Soiling Crops. — Moore, J. S., in *Mississippi Agricultural Experiment Station Bulletin* No. 174, pp. 1-16. Agricultural College, Mississippi, 1917.

I. The object of this investigation was to determine: first whether or not the continued use of cottonseed meal when fed in large quantities is injurious to dairy cows and, if injurious, the nature and character of the injury; second, whether or not the continued use of cottonseed hulls when fed in large quantities is injurious to dairy cows, and, if injurious, the nature and character of the injury.

Nine young cows were selected and divided into three lots of three each; later two heifers were added to each lot. The test continued for six years and some of the cows were in the test the entire time.

Lot 1 received a heavy ration of cottonseed meal with little other feed and no cottonseed hulls for roughage.

Lot 2 received a heavy ration of cottonseed hulls with no cottonseed meal.

Lot 3 received no cottonseed products.

A record of each cow in the test, from the time she entered until its sale, was kept, showing the number of times each cow was bred, the number of calves dropped, the dates calves were dropped and the length of time between births; the total feed given each cow during the test, the average feed per day per cow, together with the production of milk and butter fat and the abnormal conditions, if any, occurring in the case of each animal.

Results indicate that there were 14 cases of garget in cows of Lot 1, five cases in Lot 2, and two slight cases in Lot 3. In Lot 1 one cow lost two quarters of her udder and two cows lost one quarter each. In Lot 2 one cow lost one quarter. In Lot 1 three cows retained afterbirth, there

was one case of abortion, one calf came dead and another one was very weak at birth. Two cows in Lot 1 were in poor physical condition for a time. In Lot 1, and to a smaller extent in Lot 2 there was some difficulty in getting the cows "safe with calf". In Lot 2 one cow had milk fever and one died after being in test for eight months.

The feeding of five pounds of cottonseed meal for any length of time is therefore to be considered injurious to the dairy cow, causing inflammation of the udder, difficult breeding, and probably having a tendency to cause retention of afterbirth.

Feeding cottonseed hulls at a rate of 15 lbs. per day appears to cause difficult breeding, though not so the same extent as the feeding of cottonseed meal.

Where plenty of silage is available for the winter months and good pastures are provided for spring, summer, and fall so that the cows will not require much grain feeding during a large part of the year, as much as four pounds of cottonseed meal has not seemed to injure the cows in any way.

II. Three lots of seven cows each were used in the test to determine the feeding value of cottonseed meal vs. cold pressed cottonseed cake. Each lot was given the same feed for a period of three weeks, consisting of an average ration of 4 pounds of cottonseed meal, 7 pounds of Johnson grass hay, and 42 pounds of corn silage. The cows were then divided into the same lots and fed for a period of nine weeks on the following average ration for the cows in each lot.

No. of Cows		Daily ration				
		Cottonseed meal lbs.	Cold pressed Cottonseed Cake lbs.	Wheat Bran lbs.	Cottonseed hulls lbs	Johnson Grass hay lbs
Lot I	7	5	—	3	2.5	7
Lot II	7	—	7.5	3	—	7
Lot III	7	5	—	3	—	7

At the close of the test period, the cows were again put on the same average ration for each lot and fed for a period of four weeks. The ration consisted of good pasture and 4 pounds of cold pressed cottonseed cake.

Considering the average weekly milk production of the cows in each lot for the three periods, and the weight of the cows at the beginning and at the close of the test period, the results from these three rations are very nearly the same. Those from lot 2 where cold pressed cake was used were slightly better than from the other two.

Relative value of grain feeds. — From these tests, and from previous tests of the Mississippi Experiment Station, published in former bulletins now out of print, the following conclusions were drawn:

1) One pound of cottonseed meal equals 1.72 lbs. of cottonseed.
2) One pound of cottonseed meal equals 2 lbs. of corn and cob meal, or corn meal.
3) One pound of cottonseed meal equals 1.5 lbs. of wheat bran.

III. Fifteen cows were selected for this experiment and divided into three lots of five cows each. They were fed for three periods of six weeks each. During the first period of six weeks, cows in Lot 1 received purchased feeds, the cheapest that could be bought—quality considered; cows in Lot 2 were on good pasture of oats and hairy vetch; cows in Lot 3 were fed alfalfa as a soiling crop. During the second period of six weeks, Lot 1 received purchased feeds; Lot 2 were put on pasture of bermuda, white clover, smooth vetch and mixed grasses; Lot 3 were fed alfalfa and Johnson grass as soiling crops.

The cows on pasture and those getting soiling crops received about a half ration of grain feed in addition.

The market value of all dry feeds was used in estimating the cost of the feed eaten by each lot. Soiling crops were valued at the cost of production, including rent on land, cost of seed, planting, etc. Estimated values were as follows:

Cottonseed meal per ton	$ 28.00	Johnson grass hay	$ 12.00
Wheat bran per ton	28.00	Alfalfa hay per ton	15.00
Green alfalfa per ton	1.50	Cottonseed hulls per ton	8.00
Green Johnson grass per ton . .	1.50	Pasture per cow per month . . .	0.75

A comparison of the cost of feed for the several lots shows a marked difference. The cost of feeding the cows receiving purchased feeds was 18.5 cents per cow per day. The cost of feed for cows on good pasture was 5.0 cents per cow per day. The cost of feed for the lot receiving soiling crops was 9.0 cents per cow per day.

At the close of the third period the cows had been in milk since calving about seven and a half months and while above the average cow in the State of Mississippi in yield of milk and butter, they had about reached the point where with only purchased feeds the value of the milk would have little more than paid for the feed eaten. There was no great difference in the cost of feeding soiling crops and providing good pasture, but where it was necessary to purchase all the feed used the cost was more than doubled.

The value of the above facts will be appreciated when it is realized that either good pasture or soiling crops can be provided at least eight months in the year. Usually by a combination of the two methods the time can be extended to nine, or even ten months.

742 - **Skim Milk and Milk Substitutes for Calf Feeding.** — HUNZIKER, O. F. and CALDWELL R. E., in *Purdue University Agricultural Experiment Station Bulletin* No. 163, Vol. XIX, pp. 1-104. Lafayette, Indiana, September 1916.

The purpose of the experiment recorded in this bulletin is to furnish the dairyman with practical and reliable information as to the proper preparation and use of rations for calf feeding when the market value of

whole milk and its products is too great to permit of its economical use for this purpose.

Three rations were used in this experiment as indicated below.

Lot I. Ration 1 (Skim milk). Consisting of whole milk, skim milk, ground corn and oats as a dry mash, alfalfa hay and corn silage.

Lot II. Ration 2 (Home mixed calf meal). Consisting of whole milk, home mixed calf meal (containing hominy feed, linseed meal, red dog flour and dried blood, equal parts by weight), ground corn and oats as a dry mash, alfalfa hay and corn silage.

Lot III. Ration 3. (Blatchford's Calf Meal). Consisting of whole milk, Blatchford's Calf Meal, ground corn and oats as a dry mash, alfalfa hay and corn silage.

The above rations were fed for a period of 182 days to three lots of ten calves each. Most of the calves used in this experiment were pure-bred animals from cows belonging to the Experiment Station dairy herd.

The record of the performance of each individual calf was kept separately, both in regard to feeds consumed and the variation in live weight. A daily record was made of the feeds fed and the body weight was determined at the end of each seven days. At the conclusion of each thirty days the calves were photographed under standard conditions and in a way that would show the physical condition of the calf as well as the variations in size. These photographs represented six thirty day periods during the first six months of the calf's life and are presented together with a tabulated average daily summary of the feeds consumed, composition of rations, cost of ration, and variations in live weight.

The chemical composition of all feeds and the prices of feeds are given in the following tables I and II.

TABLE I. — *Chemical Composition of all Feeds used in the Experiment*

Name of feed	Dry matter %	Crude protein %	Carbo-hydrates %	Fat %	Ash %
Whole milk	11.83	3.85	5.07	3.00	0.91
Skim milk	10.05	3.96	5.30	0.64	0.75
Blatchford's Calf Meal	93.93	25.19	50.60	5.47	7.67
Home mixed Calf meal	89.51	30.45	43.70	4.80	2.76
Alfalfa hay	91.71	14.21	69.62	1.48	6.40
Oats	87.67	11.70	67.73	4.18	4.06
Corn	85.69	8.80	69.52	3.82	1.55
Corn silage	30.19	1.88	32.30	1.13	1.88
Hominy	87.68	10.67	69.98	5.55	0.87
Linseed meal	91.18	32.73	43.32	10.30	4.83
Red dog flour	87.80	15.15	69.36	2.91	1.38
Dried blood	90.70	87.26	—	0.40	2.05

TABLE II. — *Prices of Feeds used in the Experiment.*

Name of feed	Price of feed
Whole milk	1.50 per 100 pounds
Skim milk	0.25 per 100 pounds
Corn	0.60 per bushel
Oats	0.40 per bushel
Alfalfa hay	15.00 per ton
Corn silage	4.00 per ton
Home mixed calf meal	40.00 per ton
Blatchford's Calf Meal	70.00 per ton

The comparative efficiency of the various rations used is presented in following tables.

The average live weight, gain and cost of gain of the three lots is given Table III.

TABLE III. — *Showing Live Weight, Gain and Cost of Gain in Lots I, II and III.*

	Birth weight	Final weight	Total gain	Daily gain	Cost per pound gain	Average daily cost	Total cost
	lbs.	lbs.	lbs.	lbs.	cents	cents	$
Lot I	61.7	282.8	221.1	1.21	5.7	6.9	12.63
Lot II	69.6	244.1	174.5	0.95	7.4	7.1	12.93
Lot III	65.2	200.2	133.4	0.73	13.18	9.58	17.44

The average daily ration consumed is given in Table IV.

TABLE IV. — *Showing average daily ration consumed by Lots I, II and III.*

	Whole milk	Skim milk	Water	Home mixed calf meal	Blatchford's calf meal	Dry mash	Alfalfa hay	Corn silage
	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs.
Lot I	0.72	11.11	—	—	—	0.98	2.50	9.33
Lot II	1.17	—	8.64	1.33	—	0.84	2.18	6.22
Lot III	2.46	—	7.67	—	1.07	0.77	1.61	6.21

The total amount of food nutrients consumed is given in table V.

TABLE V. — *Showing total amount of Food Nutrients consumed.*

	Dry matter	Crude protein	Carbohydrates	Fat	Ash
	lbs.	lbs.	lbs.	lbs.	lbs.
Lot I	812.86	169.3	572.88	19.3	51.31
Lot II	755.69	169.0	517.66	30.1	38.89
Lot III	628.39	125.14	432.6	34.44	36.14

The average daily rations and their nutritive ratio is given in Table VI.

TABLE VI. — *Showing Average Daily Rations and Their Nutritive Ratio.*

	Dry matter	Crude protein	Carbohydrates	Fat	Nutritive ratio	Live weight
	lbs.	lbs.	lbs.	lbs.	—	lbs.
Lot I	4.46	0.93	3.14	0.106	1 : 3.6	282.8
Lot II	4.15	0.93	2.84	0.165	1 : 3.4	244.1
Lot III	3.45	0.687	2.37	0.189	1 : 4.0	200.2

The relationship between height and weight is a true index in regard to the physical condition of the calves throughout the experiment. For each inch in height, Lot I averaged 4.95 pounds or 6.87 % more than Lot II and 20.40 per cent. more than Lot III. The relation between height and live weight is given in Table VII.

TABLE VII. — *Showing Relation Between Height and Live Weight.*

	First month	Second month	Third month	Fourth month	Fifth month	Sixth month	Average
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Lot I	2.99	3.83	4.43	5.44	6.16	6.88	4.95
Lot II	3.11	3.50	4.06	4.95	5.64	6.32	4.10
Lot III	2.69	2.98	3.49	4.20	4.85	5.32	3.94

From the results presented in the preceding tables it appears that when skim milk is available as a feed for young calves and its market value is not above thirty cents per hundred pounds, milk substitutes for dairy calves are of comparatively limited value. In sections where the chief product sold from the farm is whole milk, the use of a home-mixed calf meal is advisable although the calf so produced will not be as well developed at six months of age as if fed with milk during its early growing period.

The prices charged by concerns manufacturing calf meals are usually very much above the actual cost of producing them. All things being equal so far as the efficiency of the ration is concerned, the use of a ready prepared calf meal is largely prohibitive on account of the high retail prices of such feeds.

In order for a ration to be considered an unqualified success for dairy calves, it should produce, at least, one pound of gain per day as an average for the first six months of the life of the calf. An average daily gain of two pounds is not uncommon, although slightly above that which the average dairyman may expect.

The amount of food nutrients required per day by growing calves is approximately, 0.33 lb. of protein, 1 lb. of carbohydrates and 0.05 lb. of fat, these figures being based upon the total amount rather than the amount of digestible nutrients consumed.

The rate of growth in height of dairy calves is rather uniform during the first six months of their lives. The average monthly growth for an average sized calf should be from 1.5 to 2 inches, although certain individuals may much exceed these figures.

A calf at thirty days of age should weigh, approximately, 3 pounds for each inch in height. This figure gradually increases until at six months of age the average calf should weigh, approximately, 6.5 pounds for each inch in height.

743 – **The Production of Baby Beef.** — RAY, S. H., in *U. S. Department of Agriculture Farmer's Bulletin* No. 811, pp. 1-24. Washington, D. C., April 1917.

During recent years the United States live-stock markets have undergone a great change which has reacted strongly on the breeding industry. This change is expressed by the ever-increasing demand for high-grade

ell-fattened calves weighing from 900 to 1200 lbs. This demand could ily be satisfied by animals of from 14 to 20 months belonging to the early-aturing beef breeds, Hereford, Aberdeen-Angus or Shorthorn. As this ass of animal differs markedly from other beef classes it is called "baby eef".

The production of this type of cattle demands more skill than that of der slaughter animals, since the latter is chiefly fed on the cheaper rough-ges of the farm. Farmers are also attracted to this industry by the in-reasing scarcity of feeder cattle, a scarcity often connected with the pro-ressive increase in land-values, the cost of labour, taxes, etc., which, in any districts, make it difficult to realise profits on older cattle. Thus itcher's cattle of from 3 to 5 years bred on ranches were replaced, first by ult animals fattened on mixed farms, then by baby beef raised on inten-ve breeding farms. Baby beef is obtained by using the maximum produc-ve capacity of the earliest maturing breeds, and by intensive feeding.

This change is due to many causes. Foremost of all is the fact that oung cattle make better gains than older cattle on the same quantity of oodstuff. Yearlings can make 25 to 40 % more gain than mature cattle n the same amount of food. As the period of production is shortened, is possible, with the same amount of feed and pasture, to increase the num-er of breeding cows and the number of calves produced every 18 months. Heifers, fattened on the same system, may be sold when 18 months old as hey will then weigh from 900 to 950 lbs. and will have cost the same amount s the steers. When over 2 years they are already subject to the depreciа-on of all butcher's animals. Moreover, baby beef, when fattened for arket under 2 years of age, allows the farmer to choose the moment when ood prices may be realised, for, between the age of 14 months and 2 years he animal is always in good condition for the market. The period of fat-ning may thus be lengthened when prices are low and shortened when they re high. This greatly helps to keep the market steady. The consumer refers the size and quality of the cuts from a well-bred, highly finished earling, and markets, which are more stable for this class than any other lass of cattle, are paying a premium for this product. Prime baby beef sually commands a price equal to that of the highest grade of mature at cattle.

All breeding farms are not suited to the production of baby beef, in act there are certain conditions under which it is inadvisable. A good reed of early maturing cattle, good pasture and a plentiful supply of con-entrated foodstuffs are essential to success.

As a rule pure-bred cows are not necessary, but they should have two or hree crosses with a pure beef-strain to avoid a preponderance of dairy blood hich prevents the successful rearing of baby beef. The most satisfactory esults are obtained with pure-bred selected Aberdeen-Angus, Shorthorns nd Herefords, and the herd bulls, in all cases, should be chosen from these reeds. The most recent experiments show that it is most advantageous o breed and fatten the calves on the same farm.

When breeding baby beef it is important to give them concentrated

foodstuffs with a grain basis. Except in cases in which the cows produce a certain amount of milk during the weaning period it is best to give these foods to the calves as early as possible, that is to say, when they are from 4 to 6 weeks old. Where pasture is available, autumn-born calves are turned out to graze in spring.; this enables the amount of roughage fed to be reduced to a minimum, while as much concentrated foodstuff as possible is still given. In some cases very good pasture prevents the animal from consuming the desired amount of grain, and causes a set-back in the increase of weight. During the last fattening period pasture should not be used. Where winter pastures are available they will greatly decrease the cost of both growing and fattening the calves.

The baby beef industry also helps to develop the hog breeding industry as the residues of the concentrated foodstuffs used may thus be best utilised. Shoats from 70 to 100 lbs. are used, and consume the undigested cereals given to the cattle. As maize is the chief concentrated foodstuff used during fattening, the breeding of hogs on the residues of the fattening adds greatly to the profits. From 1 to 2 lbs. of pork may be obtained for each bushel of maize fed to the calves.

Tables are given of the progressive quantities of concentrated foodstuffs which should be given to the calves month by month, both for those to be finished in 15 months and for those to be finished in 18 months, autumn and spring born calves being considered separately.

744 - **The Shorthorn in Ireland.** — *Live Stock Journal*, Vol. LXXXVI, No. 2257, p. 3. London, July 6, 1917.

In a recent publication, the Irish Shorthorn Breeders' Association describes the development in Ireland of the dual purpose Shorthorn breed. In the Department of Agriculture's Register of Dairy Cattle are entered 478 cows giving from 5 000 to 6 000 lbs. of milk, 1 601 producing from 6 000 to 8 000 lbs., 488 producing from 8 000 to 10 000 lbs., and 106 yielding more than 10 000 lbs.

The cows yielding less than 6 000 lbs. were entered in the control register before 1912, the year in which the standard was raised from 5 000 to 6 000 lbs. The importance of this selection of the Shorthorn breed in Ireland in order to produce meat as well as milk is obvious when it is considered that, before the war, Ireland exported annually to England 832 000 head of slaughter cattle, representing a value of £ 11 876 000, and 752 000 cwt. of butter, representing a value of £ 3 900 000. Moreover, the predominance of small and medium sized farms in Ireland gives a greater importance to the breeding of dual purpose animals which may meet the requirements both of the meat market and the dairy industry; this applies particularly to pure-bred Shorthorns.

745 - **Experiments in the Disposal of Irrigated Crops through the Use of Hogs.** — HOLDEN, JAMES A., in *U. S. Dept. of Agriculture, Bulletin* No. 48, 25 pp. Washington, D. C. Feb. 26, 1917.

The farmer who makes a success on high-priced irrigated land must not only grow large crops, but he must market these crops in the most ad-

antageous way. Most crops grown in localities far removed from the large onsuming centres should be marketed in condensed form, so as to reduce he cost of transportation. For example, a hundred pounds of butter can e shipped to market much more cheaply than the hay and grain required o produce this butter. The farmer should take advantage of this fact in rganizing his operations. In addition to this saving, the manure re-ulting from the feeding of the crops makes it possible to produce larger rops in subsequent yeras.

Because of the relatively small capital and short time required to get start in the swine industry and because of the high efficiency of hogs in tilizing certain field crops, swine production is a specially promising in-ustry for irrigation farmers. In order to secure information regarding ethods of utilizing hogs in the disposal of certain field crops produced n irrigated lands, experiments were conducted at the Scottsbluff Experi-ment Farm on the North Platte Reclamation Project in 1912, 1913, 1914 nd 1915.

In three years' experiments, with eight lots of hogs, and during which lfalfa pasture was supplemented with a 2 per cent ration of corn, an average gain of 3,181 pounds per season was made from an acre of alfalfa pasture nd 7,844 pounds of corn. It required an average of 2.47 pounds of corn n addition to alfalfa pasture to produce 1 pound of pork. If the gains are alued at 7 cents a pound and corn at 60 cents a bushel, or $ 1.07 a hundred-eight, the average annual return was $ 138.75 per acre of alfalfa pasture. f the corn fed is valued at 60 cents a bushel and the alfalfa pasture at $ 15 n acre the average cost of 100 pounds of gain was $ 3.11. If the average ield of the alfalfa plats in the same field is assumed to represent the yield of the pastured plats the hogs paid an equivalent of $ 25.13 per ton of ay.

In two years experiments with alfalfa pasture, with and without supplemental feed, an average annual return of $ 45.08 per acre was se-ured where no supplement was used, as compared with $ 70.20 where a 1 per cent. ration of corn was used — $ 128.40 from a 2 per cent. ration of orn — $ 121.96 from a 2 per cent. ration of barley, and $ 168.25 from a 3 per cent. ration of corn. The rate of gain and the carrying capacity of the pasture increased with the quantity of grain fed. Ground barley appeared to be as good, pound for pound, as shelled corn as a feed for hogs on alfalfa pasture.

Sows and pigs on alfalfa pasture, with a 2 per cent. ration of grain, made an average gain of 1,574 pounds per acre of alfalfa pasture from May 1 to July 1, or a net return of $ 66.84 per acre. When corn was used the return varied from $ 54.11 to $ 69.07 per acre, and when barley was used the return was $ 77.76 per acre.

In three years' experiments, hogging corn without supplementary feed produced an average of 896 pounds of gain, worth $ 65.72 per acre, or $ 1.50 per hundredweight of the estimated yield of corn.

In two years' experiments, hogging corn without supplementary feed produced an average of 744 pounds of gain, worth $ 52.08 per acre, as com-

pared with 930 pounds of gain, worth $ 65.10, where the hogs had access to alfalfa pasture, and 1,029 pounds of gain, worth $ 72.03, where the hogs were fed tankage in addition to the corn. Where no supplementary feed was used the hogs paid $ 1.34 per hundredweight for the estimated yield of corn, as compared with $ 1.55 per hundredweight where the hogs had access to alfalfa pasture and $ 1.50 per hundredweight where tankage was used. The use of either alfalfa or tankage resulted in more rapid and cheaper gains than were secured where no supplementary feed was used.

746 - **Profitable Pork Production in the United States.** — WALTER, H. B., in *Missouri State Board of Agriculture*, Monthly Bulletin, Vol. XIV, No. 8, pp. 21-25, Columbia, Mo., 1916.

The pork production branch of the live stock industry of the United States supplies over sixty per cent. of the meat diet of the country.

One reason the hog is such a great factor in meat supply is because of his prolificacy. The increase from cattle is estimated to be from 80 to 90 per cent. in one year; of sheep it is from 100 to 150 per cent.; while in hogs it is from 1000 to 1800 per cent. yearly. The hogs can populate the farms with meat producing animals in a short time and *overcome any meat shortage that may exist.*

The hog is a very efficient animal because he can produce a pound of meat from less than any other animal. It requires about thirteen pounds of dry matter to produce one pound of gain in cattle, about eight to nine pounds in sheep and only four to five pounds in hogs.

The hog dresses a higher per cent of edible meat. Cattle dress from 60 to 65 per cent., sheep 55 to 60 per cent., while hogs dress from 75 to 80 per cent.

There is more energy in a pound of pork than in either a pound of beef or mutton. Comparing fresh ham with fresh hindquarter of beef and mutton, a pound of the ham has 60 % greater energy value than a pound of mutton and 45 % greater energy value than a pound of beef.

The essentials in producing hogs at a profit in the United States are the following: the person engaging in the business must have a liking and capability for the business; have a good location; select well bred animals; have a reasonable amount of equipment; feed a balanced ration, *including pasture*; keep the herd free from disease; find or make a good market for the product and last, but not least, keep an account with the herd, so that it may be known whether the hogs are making a profit or loss, and how much.

747 - **Breeding for Egg Production - A Study of Annual and Total Production.** IVES, E. D., BYRON ALDER and EGBERT, A. D., in *Utah Agricultural College Experiment Station Bulletin* No. 148, 60 pp., 22 tables. Logan, Utah, December, 1916.

Work on White Leghorns at the Utah Experiment Station aims at establishing the factors upon which to base a rational system of selection for increased egg production. The present paper gives the two-year records of the Station flocks from October 1913 and discusses annual and total production.

The following conclusions are drawn from the records:

The production of unselected White Leghorns varies in different years as influenced by the environment, but from all available records averages about 130 for the first year, 120 for the second and less than 110 for the third, drops to about 85 in the fourth and falls about 10 eggs a year after this up to the eighth year. Selected flocks have averaged about 160 in America and 190 in Australia. The American record corresponds closely to the average upper one-half of the unselected flocks and indicates that the selection has been able to eliminate the lower half.

The first year production of a flock of White Leghorns is no indication of their total production, if the first year is high the second will be low, if the first is low the second will be high, but the total production in three years will in all cases be about the same.

If the first year record of a flock is high, selection of the high layers will materially improve the later production of the flock. If the first record is low there will be little value in selection as even the lowest producer will make a second year record above the general average. The three year average is in all cases a much more reliable indication of productivity.

The average life of a White Leghorn appears to be about 6 years. The average total production is above 500 eggs and the maximum possible production above 1000.

The White Legorn is the most important egg producing breed at the present time; over one half of all contest entries are Leghorns. The average production has been decidedly above the average of the general purpose breeds. Three-fourths of all contest entries have been white.

A Bibliography is appended which cites 40 publications.

45 - **Grafting of the Ovary in Rouen and Pekin Ducks.** — KALTENBACH, R., in *Zeitschrift fur induktive Abstammungs- und Vererbungslehre*, Vol. 27, Part 3, pp. 251-253. Leipzig, March 1917.

In researching on the question of the heredity of acquired characters it is necessary to know whether the fres happearance of the same character in the mother and her descendants is due: *a*) to the fact that the body of the mother and the germ cells have been influenced in like manner by external factors, or *b*) to the fact that external factors first modified the maternal organism, this modification afterwards being transmitted by the body to the germ cells.

In order to confirm the possibility of the second phenomenon occurring, GUTHRIE in 1908, made experiments on transplanting the ovary in black and white fowls, the results of which proved, according to GUTHRIE, the transmission of new somatic characters to the germ cells. He had grafted the ovary of a black fowl upon a white fowl whose ovary had been removed and after crossing this latter with a black cock obtained black and white offspring. DAVENPORT explained this result by saying that the ovary of the white fowl had only been partially eliminated, the remainder of the ovary was regenerated and the new ovary belonging to the black race reabsorbed.

The present writer has repeated GUTHRIE's experiments on pure races of ducks.

Firts of all he established, by means of preliminary experiments, that owing to the interlacing of the ovary with the vena cava it is quite impossible to detach the former completely. Detachment of a portion of the ovary is naturally not difficult. He was therefore obliged to destroy the ovary (about the size of a bean) in another way; this was accomplished by the use of 40 % formalin. On killing the animal after treatment it was seen that the ovary was completely hardened. In order to make quite sure that the ovary left no remainder capable of regeneration, a couple of Pekin ducks were kept for a whole year after cutting; after the first moult both had typical male plumage; dissection showed that the ovary had disappeared.

Complete removal thus being certain, the writer exchanged the ovaries of Rouen and Pekin ducks, 8 weeks old. After a year it was seen that the grafted ovaries had disappeared and on the completion of the spring moult there appeared the characteristic plumage of the male bird.

The writer's results thus confirm DAVENPORT's conclusion noted above.

749 - **New Hive with Store Chamber: the "Sans Souci".** — FOURNIER, M., in *L'Apiculteur*, 61 st. Year., Nos. 3 and 4, pp. 50-54. Paris, March April 1917.

The writer gives a description of his new hive, the "Sans Souci", and shows the great advantages resulting from its use. It is neither on the hori-

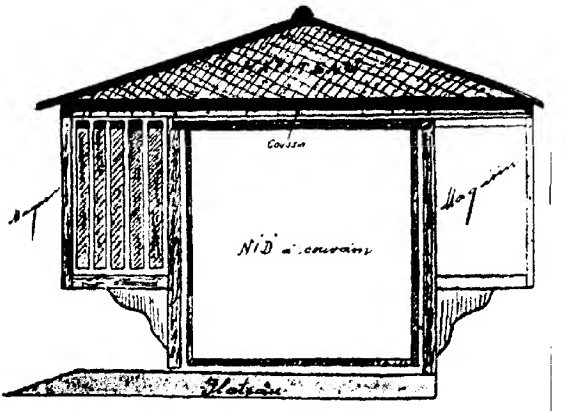


Fig. 1. — Vertical section of the «Sans Souci» hive.

zontal nor vertical system but owing to the suppression of the additional racksit resembles more the horizontal hives than any other.

As shown in fig. 1, it consists of a hive body, intended for brood, to the front and back of which are suspended two box-compartments serving as store-chambers, the front one overhangs the entry and thus avoids the use of a hood. These compartments are arranged to receive 5 super frames. They communicate with the brood chamber by means of a horizontal slit, not more than 4 mm. long, which only allows the workers to enter and is closed by means of a key of strong flattened wire which can be worked from the outside (fig. 2). As only the worker can enter the store chambers, the frames will always be free of brood.

Owing to these chambers forming a double wall or air cushion, the temperature of the brood chamber is constant and the hive can be built of 15 mm. match-boarding.

The system of communication between the brood and store chambers allows one to examine the frames at any time without having to smoke the

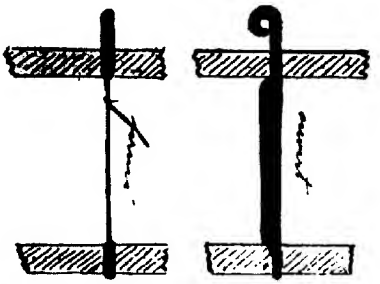


Fig. — Key for opening or closing passage to store chamber.

hive : a little smoke in the store chambers is sufficient to chase off the workers.

If artificial feeding is required, the necessary frames or syrup can be placed in the store without disturbing the whole hive. It is useless to store the frames in the laboratory where they are only in the way ; after extraction of the honey they can very well remain in the store chambers till the following crop where they are protected from parasites.

In usual conditions the hives require visiting 5 times in the course of the year. With the " Sans Souci " the process is as follows :

1) In spring the state of the colony can be ascertained by looking through the piece of glass along the edge of the frames.

2) At the time of the honey flow in May or June, when an additional rack is added to the usual type of hive, the only thing to be done with the hive under consideration is to give the key a half-turn in order to let the bees have access to the store-chamber.

3) At the end of the season when after looking through the observation panes behind each store chamber the frames are seen to be full, the bees

in these latter are chased off with a little smoke, the passage closed and the frames removed.

4) The empty frames are replaced in the store-chamber without disturbing the bees, as until the passage is opened they are unable to enter.

5) During the winter the passage communicating with the store-chamber must be kept closed as it might prove fatal to the bees if they were to remain within.

Instead of 5 visits, one visit only will suffice, *viz.* in spring in order to make sure of the condition of the colony and to clean the baseboard.

750 - **The Pebrine Disease of Silkworms in India.** — HUTCHINSON, C. M., in *Agriculture Research Institute, Pusa, Bulletin* No. 75, pp. 5, 2 Pl. Calcutta, 1917.

In the course of his enquiry into the causes of the decadence of the Indian Silk Industry, Prof. LEFROY came to the conclusion that the chief cause is the great prevalence of the "Pebrine" disease of silkworms. PASTEUR, who discovered the cause of the disease to be a microscopic organism, also devised a method of checking and diminishing the disease. This method has been in successful use for some 40 years in France and Italy, and as Prof. LEFROY's inquiries showed that the Pasteur method for eliminating pebrine has been a failure, the present writer commenced an enquiry into the subject with the view of finding out why the PASTEUR method had failed in Bengal and if possible to discover a suitable modification or alternative. The present Bulletin gives an *interim* report on the writer's investigations to date.

The essence of the Pasteur method consists in the fact that the pebrine bodies — the spore form of the parasite — as seen when the body of the moth is crushed in a little water, a drop of the resultant fluid being examined under a magnification of 500-600 diameters, are easily recognizable. If pebrine bodies are seen, the eggs of this moth are destroyed. *The success of this method for eliminating the hereditary infection depends on the assumption that if there is sufficient disease present in a moth to affect the progeny, its presence will be detectable by the above method.*

As far as India is concerned the method requires serious modification. The essential difference between European and Indian conditions is that in Europe there is only *one* generation a year, while in India usually *seven* or *eight* generations are produced. Again, in India the eggs hatch out within some 8 days after laying, while in Europe the eggs are laid in summer and do not hatch till the following spring. Therefore in India the moth must be examined within a week after egg laying. It was further found that a large percentage of diseased moths were passed as disease-free under these conditions.

The writer found that the above assumption on which the Pasteur method is based does not hold good for India. In India the fresh body has to be examined (in Europe the dried body) so that the liquid for the test is mostly obtained from the colon, an organ found to little invaded by the parasite in comparison with the ovaries and other parts of the body.

By examination of a large number of pebrinised moths, it was found

t the pebrine "corpuscles" first seem to appear or are to be found if sent at all, in the gut or chyle stomach. The gut is readily accessible separating the lower portion of the abdomen, leaving the gut canal exed. A portion of the gut removed with a needle and rubbed in water on lide will show the presence of pebrine bodies if they occur in sufficient mber to be detected by such a rough microscopic examination.

The reason why pebrine is more likely to be detected by examination the tissues of the gut is that the moth is infected (excepting hereditary ection) through the food and alimentary canal; the parasite enters and eads from the walls of the gut. It then follows that as the parasite ows by feeding on the tissues of its host, the food supply afforded by the ter must fail at the point first invaded. As failure of nutriment causes e parasite to pass into the spore condition, the condition most easily ognizable under the microscope, it is obvious why the gut tissues present e most likely point for discovering the presence of the parasite. Again, e gut elements in the moth are known to reconstructed during the pupal ge from the same as those in the larva from which they are derived.

The writer advocates the use of the above method in India to obtain seise free eggs for rearing those races that produce several generations year.

1 - **On the Biology of the Shad (*Alosa finta* Cuv.) of the Algerian Coast.** — Bornhol J. P., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 10, pp. 480-483. Paris, May 19, 1917.

Following the example of Roule (1), the writer has been lately research- as to whether the factor determining the migration of the shad was t of the nature of a respiratory tropism, the fish seeking the waters of high- t oxygen content.

By dissolving different quantities of oxygen in sea water, fresh and rackish water at different times of the year, the writer has obtained results a definitely conclusive character and completely confirming those btained by M. Roule.

The differences in degree of oxygenation existing between sea water nd fresh water in spring favour the former, and in winter the latter; this xplains why the spawning migration of "potomatoques" (species living in he sea which periodically spawn in freshwater) takes place in spring, hilst that of "talassotoques "(species living in fresh water and spawning n the sea) takes place in autumn or in winter.

2 **Fish-breeding in Switzerland during 1916** (2). — *Bulletin Suisse de Pêche et Pisciculture*, Year XVIII, No. 5, pp. 75-78. Neuchatel, May 1917.

The number of breeding stations during 1915-1916 was 224. From 57 071 000 eggs the number of larvae hatched out was 127 033 000. Of hese, 126 222 400 were set free in Swiss public waters under official control. hese included 58 393 of a single summer or a year old. The numbers f larvae of different species bred in hatcheries was as follows:

1 See *B.* 1916, No. 453 and *B.* Jan. 1917, No. 70.
2 " *B.* 1915, No. 893.

A. — *Native species.*	
Salmon	1 722 000
Salmon trout, hybrids	97 000
Lake trout	2 503 000
River and stream trout	9 986 000
Salmo alpinus ("ombles-chevaliers")	1 303 000
River charr	2 577 000
Coregonus	92 328 000
Pike	13 287 000
B. — *Foreign species.*	
Rainbow trout	215 000
American river charr	15 000
Total	127 033 000

The confederation has paid to the Cantons for distribution among the fish breeders concerned a subsidy of 34 700 francs for the incubation of eggs and releasing the larvae in public waters. The Canton of Valais is not included in this figure, as breeders there have not applied for a subsidy. No breeding has been carried out during the season in the cantons of Appenzell, Rhodes Intérieures.

The Swiss Society for Fishing and Fish-breeding has received a Government subsidy of 3 000 francs. As in the case of other river states, the Swiss Federation has granted a subsidy of 300 francs to the International Union of Fishermen on Lake Constance to cover the cost of stocking this lake with fry in 1916. During this same year Swiss fishermen have taken from the lake, including the Lower one, 135 494 kg. of fish worth 206 833 francs.

The number of bailiffs in the service of the Cantons during the fishing season was 164 with 7 temporary assistants. The salaries, travelling expenses, etc., of these guards amounted to 109 098.70 francs. 50 % of this sum was borne by the Confederation. The Cantons have spent a further sum of 604 francs on destroying animals injurious to fish.

Fish ladders have been built in the neighbourhood of the power-station at Eglisau and elsewhere along the Rhine and also near the factories at Aarau.

The Swiss Central authority has obtained data from the various cantonal governments relating to fish ladders in the different waters. These data are to serve as a basis for a careful study of the whole question of fish ladders.

FARM ENGINEERING.

753 - **Mechanical Cultivation in France.** — DANTHIN, CH., in *Le Génie Civil*, Vol. LXV, Year 37, Nos. 15 and 16, pp. 237-240 and 256-260. Paris, April 14 and 21, 1915.

The writer emphasises the importance of mechanical cultivation and gives an account of the legislative measures taken in France in order to encourage its development. He then examines the conditions which govern the use of mechanical power and describes the principal types of tractors tested during the last 2 years. He also gives an account of the economic results obtained in recent trials.

TRACTORS. — Among the tractors employed in France, which are ually petrol or paraffin driven the following may be quoted :

1) The LEFÈVRE tractor is on the creeping track system. In the odel shown at the trials at Choisy-le-Grand, in 1915, which has a steer- g axle with two wheels, the transmission and the mounting are simplified r the introduction of a new change speed gear which reduces the number pairs of gears engaged to two at all speeds.

2) The GOUGIS tractor, with 4 cylinder petrol 15 H.P. engine with ro 3 ft driving wheels,and 0.22 m. tire and a steering wheel 0.55 m. in ameter. The weight is 1 400 kg, the size, 3.40 m. × 1.75 m. × 1.60 m.

3) The DOISY winch-tractor is used for ploughing with cables, for rvesting (direct traction), carting and for driving machinery. The motor 4 cylinder, 20 H.P. There are 3 speeds and a reverse. The cable, ound by the winch, has also 3 speeds : 0.40 m., 0.85 m. and 1 m. per second.

4) The CASE tractor (1) of which there are several types. The 10-20 .P. tractor has 3 wheels, the front one, which is furnished with grips, is aced in the same line as the big driving wheel furnished with land grips. ie motor has 4 vertical cylinders. The length of the wheel base is 1.92 .. the total length 3.80 m. and the width 1.70 m.

5) The AVERY tractor (2) is of American make and has the back heels of very big diameter : 1.75 m., with very broad tires. The motor 25 H. P. The weight of the tractor is 5 190 kg. The size 4.50 m. × 2.30 m. 2.80 m.

6) The TOURAND LATIL motor plough is composed of two separable rts, the tractor and the plough. For ploughing purposes the 2 portions rm a complete whole capable of being driven by a single man. • It has a ain drive. The back wheels are 1.10 m. in diameter and 0.27 m. wide ; e front wheels are 0.95 m. in diameter. The 4 cylinder engine runs at 00 revolutions per minute. It has two speeds (3.500 km and 5.500 km) d a reverse. The plough is 5-furrow, joined to the chassis by ans of a rocking lever which brings the pull to the centre of the assis.

7) The AMANCO tractor, known in England as the " Overtime ", of American make. The motor (3) is 24 H.P. with 2 horizontal cylin- rs and uses paraffin. The two driving wheels at the back are 1.30 m. in ight. The machine is guided by means of two chains winding around a rizontal winch which is worked by means of a steering wheel. A spring take up shocks is placed between the extremity of each chain and the front le.

8) The BARONCELLI tractor was tested in 1916, at Noisy-le-Grand. has 3 wheels, the two back ones being driving wheels. The 4 vertical linder motor is placed above the back axle (fig. 5) ; note the starting crank the petrol tank *c*, and the radiator *d* of the SOLER type used on the Paris

(1) See *B.* 1914, No. 557 — *B.* March 1917, No. 274.
(2) See *B.* June 1917, No. 670.
(3) See *B.* 1916, No. 806. (*Ed.*)

motor omnibuses. The transmission is contained in *e*, the differential in *f* whence 2 chains drive each wheel. As one of these wheels is to run in the furrow, its axis is capable of vertical displacement in relation to the other wheel working on the smooth in order for the chassis to remain parallel with the ground ; this displacement is obtained by means of the screw *g*, the nut of which is turned backwards and forwards by means of the mechanism *h*, worked by the motor ; during displacement the hub turns in the curved groove *i*. The driving wheels can be fitted with grips *k*. About $^4/_5$ ths. of the total weight being carried by the back axle, direct coupling from the rear of the chassis becomes impossible as the pull would be capable of upsetting the balance of the tractor and so tipping up the front wheel. To overcome this difficulty, the inventor has carried the pull of the coupling hook to the front by means of two rods fixed to two brackets *l* fixed below the chassis and in front of the driving wheel.

9) The SALVERT tractor (1) is carried in front by two large drums which are guided by means of chains winding round two horizontal winches controlled by the steering wheel. The motor has 4 cylinders. The chassis is hung on plate springs both over the front rollers and over the axle of the driving wheels ; this allows of a speed of 10 to 11 km. per hour on the road. In the fields the driving wheels are fitted with grips of 20 cms. projection.

10) The EMERSON tractor (2) is carried on three wheels, of which one is a big driving wheel at the back.

11) There are two distinct types of MOGUL tractor (2), one 16 and the other 25 H.P. The latter took part in the French trials in 1916.

12) The MISSVALLEY tractor (3) has a 4-cylinder motor making 800 revolutions. The speeds are 2.5 km. and 4 km. per hour.

Besides these tractors, the writer describes a motor tipping waggon on the STERLING system.

RECENT EXPERIMENTS ON MECHANICAL CULTIVATION. — The writer mentions the various trials with tractors held in the spring of 1916, at Gournay-sur-Marne (4), Noisy le Grand and Provins. The following tables summarise the results in the petrol consumption tests and the main facts of working.

The figures in Table II are the maximum figures which should not be exceeded in practice.

The trials conducted last autumn in the neighbourhood of Paris, following the instructions of the Minister for Agriculture, were specially directed to studying the various existing agricultural machines capable of being replaced by tractors and similar inventions.

The trials were divided into two groups : 1) raising potatoes ; 2) cultivation For raising potatoes the firm of PILTER was the only one to compete and showed a machine with jointed forks of Frenh make, drawn by a 1[illegible]

(1) See *B.* June 1917, No. 577.
(2) See *B.* 1916, No. 670 — *B.* March 1917, No. 274.
(3) See *B.* 1916 No. 670.
(4) See *B.* 1916. No. 670.

(*Ed*

TABLE I. — *Fuel consumption trials with motors running light.*

Tractors	Average number of revolutions per minute	Consumption of petrol per hour
Hogul-16 H. P.	490	1.04 kg.
Hogul-25 H. P.	550	3.58
Emerson (carburettor A.)	800	2.50
» (» F.)	800	3.00
Carmicelli	700	6.68
De Salvert	800	3.94

TABLE II. — *Consumption per hectare and per hour.*

Tractors	Order	Ploughing: Depth in cms.	Ploughing: Width of track in metres	Average speed of plough per hour, in metres	Average time required for turning seconds	Time required to plough 1 hectare hours and minutes	Area ploughed per hour	Consumption of petrol: per hour kg.	Consumption of petrol: per hectare kg.
Hogul-16 H. P.	[illegible]	16.0	0.97	[illegible]	25	4.18	2 325	5.66	24.3
Hogul-25 H. P.	[illegible]	20.9	1 26	[illegible]	34	4.4	2 460	6.72	27.3
Emerson	3	15.7	0.61	[illegible]	30	4.48	2 083	8.60	41.2
	4	22.7	0.58	2 592	30	9.12	1 087	5.40	49.6
	5	17.5	1.00	2 772	40	5.18	1 887	5.50	29.1
	6	15.0	0.94	3 600	25	4.8	2 421	6.90	28.5
	7	20.4	0.94	3 402	25	4.14	2 364	7.26	30.7
	8	13.0	0.04	2 772	30	4.25	1 886	7.86	40.9
	9	18.0	0.88	2 700	30	4.47	1 774	8.51	49.0
Farcot III	10	14.6	0.80	3 600	18	4.38	2 155	[illegible]	53.8
	11	15.4	1.00	2 664	31	5.12	1 923	[illegible]	49.5
	12	17 1	0.60	3 672	35	6.43	1 488	[illegible]	76.1
	13	26.7	0 65	2 268	38	9.29	1 054	8.26	78.3
De Salvert	14	15.0	2.42	3 240	54	2.2	4 902	10.74	21.9
	15	17.6	2.40	3 132	54	2.5	4 784	13.20	27.5

H. P. Avery tractor. In the trials the tractor substituted a team moving at 0.83 m. per second, communicating to the forks of the potato raiser a speed at the circumference of 2.70 metres per second.

The cultivation tests were performed with apparatus belonging to the 3 following groups :

1) Riding ploughs driven direct or by cable, working one or more furrows, for ploughing with headlands, or for in and out ploughing.

2) Special purpose ploughs driven direct or by cable : cultivators, scarifiers or pulverizers, etc.

3) Machines for supplementary work, driven direct or by cable : harrows, rollers, clod-crushers, etc.

These machines have all given good results.

Several of them possess arrangements to allow of their being operated by disabled persons.

The writer records further trials carried out in the course of 1916, the results of which may be summarised as in Table III.

TABLE III. — *Trials during* 1916.

Districts	Tractors tested	Nature of work and soil	Time required to work 1 hectare (2.2 acres)	Consumption of fuel per hectare	Cost of fuel per hectare
Jolibois	Emerson-Mogul 16-25 H.P. Lefebre	clay soil	6h. 20 to 9h. 55	41 to 139 litres of petrol	—
Avignon	Emerson-Mogul-Bull-Amanco	ploughing of stubble	2h. 17 to 3h. 20	18 to 27 litres of petrol 22.79 litres of paraffin	10.26 fr. to 17.34 fr.
	Emerson-Mogul-Bull-Amanco	depth 20 cms	3h. 36 to 4h. 22	27.45 litres to 37.80 litres of petrol 31.50 l. of paraffin	17.87 to 26.42 14.17 fr.
Toulouse	Baby-Bull-Mogul - 16 H. P. Emerson	depth 15 to 20 cms.	5h. to 11h. 6m.	40 to 70 litres of petrol	—
Tours	Bull-Mogul 16 H. P. / Case 20 HP. and Emerson / Mogul and Amanco	depth 15 to 19 cm corn stubble	1972 to 2847 sq. metres per hour	22.40 to 44 litres of petrol 41.6 and 47.7 litres of paraffin	—

According to careful experiments carried out with a tractor belonging to the Syndicate for mechanical cultivation of Etampes, the cost price of ploughing about 9 hectares to a depth of 14 cms. was made up as follows:

Petrol	350 litres	at	0.67 fr.	=	234.50 fr
Oil	24 »	»	1.50 »	=	36.00 »
Valvoline for transmission	8 »	»	0.90 »	=	7.20 »
Grease	2 »	»	1.50 »	=	3.00 »
Mechanic	7 days	»	8.00 »	=	56.00 »
Assistant	7 »	»	6.00 »	=	42.00 »
Depreciation and upkeep reckoned according to hours of actual work	45 hours	»	2.00 fr.	=	90.00 »
					468.70

The fuel consumption figures per hectares are:

Petrol	39.32 litres
Lubricants: oil	2.69 »
valvoline	0.90 kg
grease	0.22 »
Cost of ploughing per hectare	52.00 fr.

The writer describes the method for calculating the cost of ploughing used by M. de PONCINS (1).

EMPLOYMENT OF ELECTRICITY IN AGRICULTURE. — M. DANTIN describes what has been done recently in this connection. He states that the splitting up of land in France still forms an obstacle to the employment of electricity in agriculture. The power required to do all the work of a farm is comparatively small: 10 to 25 kilowatts per hectare yearly. But the installation will cost from 10 000 to 15 000 francs unless the farmer is situated within 3 or 4 km. from a high tension cable. It would be necessary for to cooperate in order to establish a distributing cable. A number of supply companies have already obtained a good many farmer customers, but more particularly for running electric motors to raise water for irrigation.

The writer records several applications of electricity to agriculture; among others he mentions an installation in a farm of 250 hectares, situated in the Department of the Eure, the electricity being generated by an 18 H. P. gas engine. This installation cost 16 250 fr. and the annual expenses are 1 964 fr., including interest and depreciation. The use of electricity has saved 4 000 fr. a year, of which 2 500 fr. for threshing.

Among collective enterprises, that of Eure-et-Loire mentioned by M. LEVY-SALVADOR in the *Revue Electrique* is said to have given the best results. This Co-operative Society was formed in 1916 among 88 farmers working 1100 hetares and extending over to 6 adjoining communes The capital is 33 500 fr. divided into 25 fr. shares. The electric installation includes two 35 to 40 H. P. gas engines working the dynamos producing 460 volts. The accumulators have a capacity of 150 ampère hours.

During the first season, the receipts rose to 15 121 francs; in the second season they reached about 22 000 francs. The farmers made large savings on their farm-work, especially on threshing. This economy is calculated at 60%

Fig. 1 — LEFÈVRE tractor.

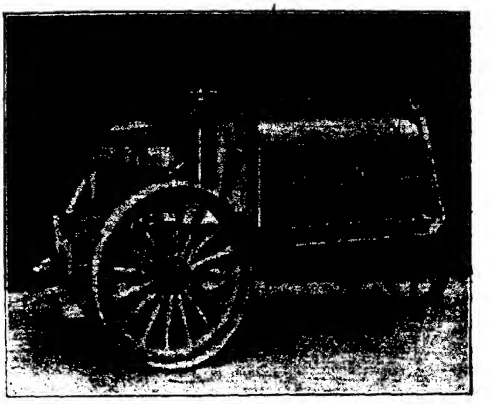


Fig. 2. — Gouais tractor.

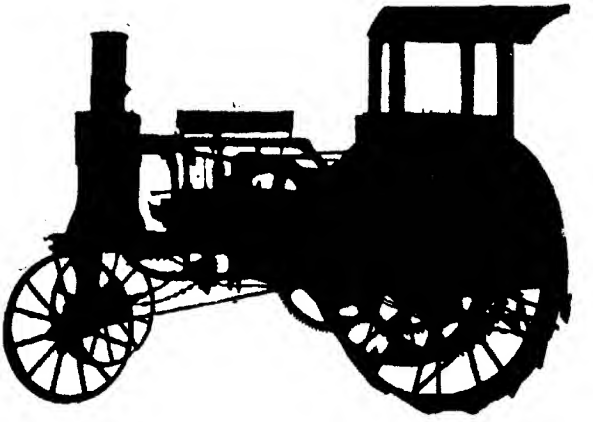


Fig. 3. — Avery tractor.

Fig. 4. — TOURAND LATIL Motor plough.

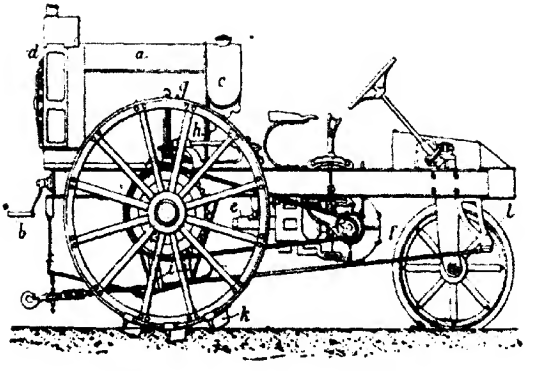


Fig. 5. — Side View of BARONCELLI tractor.

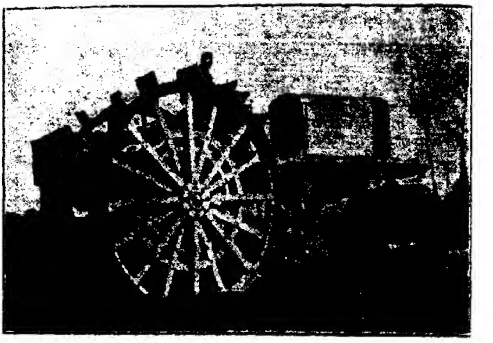


Fig. 6. — SALVERT tractor.

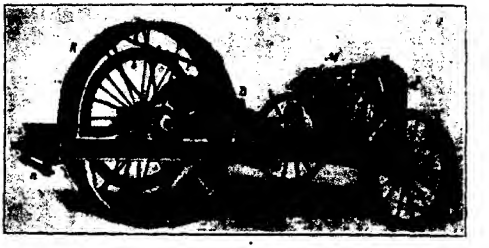


Fig. 7. — EMERSON tractor.

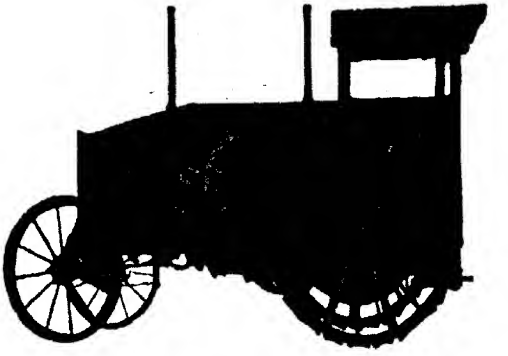


Fig. 8 — MOGUL tractor.

4 - **The Actual Extent of the Use of Motor Tractors on American Farms.** — *The Economic World*, N. S. Vol. XIII, No. 14, pp. 482-463. New York, April 7, 1917.

An investigation recently conducted by the Office of Farm Management the U. S. Department of Agriculture in cooperation with the Bureau of op Estimates has ascertained as closely as possible the number of gasoe and kerosene tractors which will actually be in use during the coming ason in the various States. The 32 000 agents and correspondents of the reau of Crop Estimates were instructed to gather the figures for their spective districts not including in their returns steam driven tractors, actors purchased but not delivered, tractors out of commission or not to used this season or tractors primarily employed for road work or work her than farming. A compilation of the report showed a total of 34 371 soline or kerosene tractors, the actual ownership of which by farmers was early established and the intention to use which during the season of 917 was fairly well ascertained.

The following table shows the number of tractors found in each of the ates:

Alabama	313	Maine	53	Ohio	1305
Arizona	23	Maryland	190	Oklaloma	795
Arkansas	336	Massachusetts	91	Oregon	318
California	1358	Michigan	945	Pennsylvania	595
Colorado	525	Minnesota	1575	Rhode Island	30
Connecticut	47	Mississippi	377	South Carolina	387
Delaware	34	Missouri	1141	South Dakota	1527
Florida	71	Montana	898	Tennessee	442
Georgia	543	Nebraska	1773	Texas	2235
Idaho	262	Nevada	19	Utah	88
Illinois	3202	New Hampshire	23	Vermont	75
Indiana	1852	New Jersey	107	Virginia	434
Iowa	2223	New Mexico	83	Washington	209
Kansas	2287	New York	1210	West Virginia	90
Kentucky	348	North Carolina	452	Wisconsin	904
Louisiana	343	North Dakota	2137	Wyoming	186

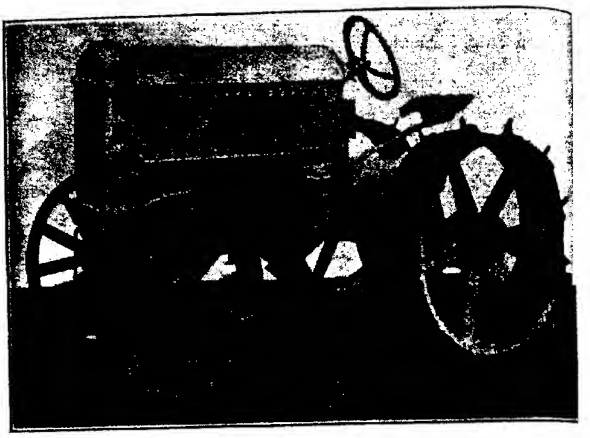
5 - **The New Ford Tractor.** — I. *Le Génie Rural*, Year 9, No. 67, p. 13, 1 fig. Paris, 1917. — II *The Implement and Machinery Review*, Vol. 43, No. 507, pp. 293-294, 1 fig. London, July 1, 1917.

The Ford tractor, which has recently been tested with good results y the Royal Agricultural Society of England, has the following chief points:

The tractor (fig. 1) has no real chassis: the radiator is fixed directly to the he motor which is supported by arms attacked to the axle. The wheels re of steel and all the working parts are completely closed in to protect hem from dust and mud.

The tractor weighs less than a ton; it has the special FORD magneto,

and a thermosiphon cooler, etc. The motor is a large size of that used in the automobiles; it has 4 cylinders (bore 102 mm., stroke 114 mm.) giving 20 brake H.P. with a 10 H.P. pull at the draw-bar. There are 3 speeds and a reverse; the drive being of the back-axle type. The tractor does about



FORD TRACTOR.

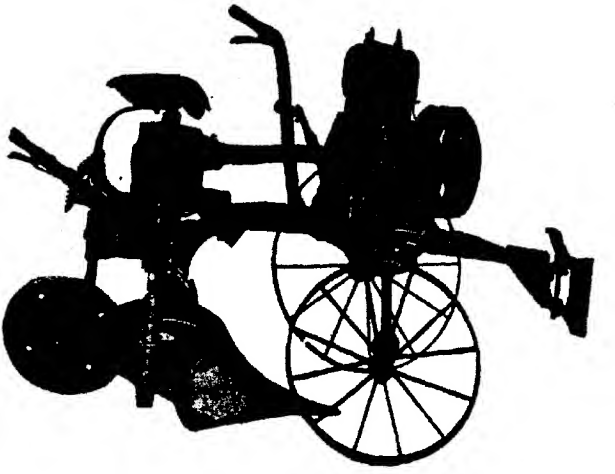
miles an hour on the road and 2 to 3 when in the field. The steering is by a bevel year. Searchlights for night working are lit from the magneto.

The tractor is built solidly and simply, and is said to cost about 7 dollars, though the price has not yet been fixed.

756 - **The "Once-Over" Tiller.** — *The Implement and Machinery Review*, Vol. 43, No. p. 176. London, June 1, 1917.

This tiller is quickly and easily adapted to an ordinary riding plough and consists of a steel tooth rotor, set to the right of the share and mould board. The rotor is geared at the top of the shaft of a small gasoline motor which whirls the rotor at about 500 revolutions per minute. The rapidly revolving rotor catches the liftings from the plough just as the soil turns over from the mouldboard, and the teeth of the rotor shred and tear the weeds, grass, roots, fertiliser and soil into a finely pulverised mass, throwing it out behind, and making, it is claimed, a perfect and mellow seedbed for the sowing of any crop.

The machine, which is made by the SCIENTIFIC FARMING MACHINE Co., Minneapolis, U. S. A., is said to have given satisfactory results in tests made by some of the most important agricultural colleges in the United States.



The " Once-Over " tiller.

757 - **Devices for Disabled Farm-hands.** — GUILLAUME, A. C., in *La Nature*, No. 2275, pp. 278-283. Paris, May 5, 1917.

In France, 70 % of the total number of labourers are employed on farm work, and it is therefore logical to suppose that the same proportion will occur among the wounded.

The writer reviews the various methods for making use of disabled men according to the type of and the possibility of their improvement. With regard to those who have been wounded in the lower limbs it would be best to eliminate them from work which required much walking or rapid movement. They could be utilised either for the indoor work of the farm or as drivers of tractors, or again for working stationary machinery such as threshers.

On the other hand, the place for a man with a disabled arm is in the fields: with the help of an artificial aid he is capable of performing various kinds of work in turn; drive a team, reap, even dig and look after crops and trees generally.

The improvement of injuries depends upon medical or surgical treatment and upon education. The latter involves the following:

a) Education of the healthy limb to act as leading aid. This will be the personal care of the wounded man himself;

b) The modification of the stump, which forms a kind of preparation of the patient before receiving his apparatus. This is the domain of the doctor or surgeon;

c) The choice of the apparatus requires exceedingly careful study.

The devices for the lower limbs differ very little from those in ordinary

Devices for Disabled Farm-hands.

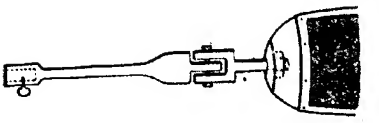


Fig. 1. — Forearm with elbow joint.

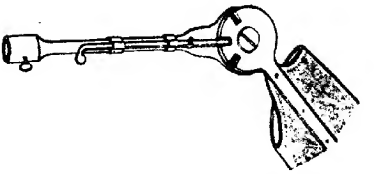


Fig. 2. — Elbow joint with bol for fixing arm at different anglet.

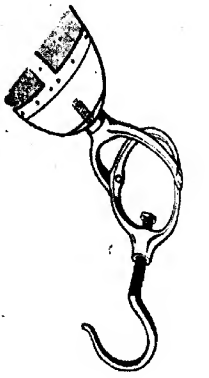


Fig. 3. — Hook for navy.

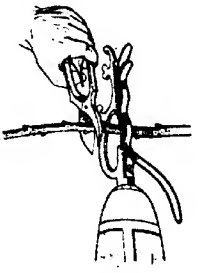


Fig. 5. — Hand for vine-dresser.

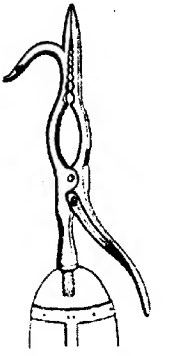


Fig. 4. — Hand for pruning

Fig. 6. —For holding reins.

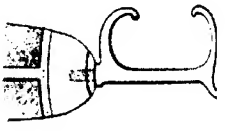


Fig. 7. — Hook for driver of tract

They should be strong, not too heavy, and with interchangeable parts, to procure at a minimum expense.

A longer description is given of the devices for arms. These are highly ialised for agricultural use. The artificial aid consists of a cap fitting r the damaged part and of a stem ending in a socket to receive a hook or r substitute for a hand.

Fig. 1 shows an apparatus for an arm amputated about a third of the down. It consists of: 1) a stem replacing part of the humerus; 2) int; 3) a stem representing the bone of the forearm and ending in a et for artificial hand.

Instead of the straps which serve for a hand, the JULLIEN (1) tool- ler is preferable for the farm labourer. The BOURREAU series of hands nits of a much greater number of different actions than the other sys- s. They fit into the tool-holder and have the advantage of being rchangeable according to the different requirements.

BOURREAU has thought out 6 different hands, of which 5 are for king purposes and 1 one for use when at rest.

The working hands are: for navvy (fig. 3), for vine-dresser and forester 4 and 5), for driver of vehicles (fig. 6) and two hands for drivers of trac- (fig. 7).

These devices allow all wrist movements to be copied The hand for navvy is formed of a moveable ring furnished with a hook, which can ier swing or be fixed. It can serve for a number of actions: digging, ughing, pushing a wheel-barrow, pulling a hand-cart, working a pump, ling a pail, a basket, etc., loading manure, driving a cart.

For driving a team the hook is replaced by a reingrip which allows driver to drop the reins easily when necessary. The hands are capable oing used for pruning and certain indoor jobs, such as the preparation cions for the vine-dresser, cuttings for the gardener, etc.

The object of the double hook for motor-drivers is to allow of the mo- ients of pushing and pulling and such other actions as are required working the levers.

- Review of Patents.

Tillage Machines and Implements

ria 73 792 — 73 822. Motor ploughs.
73 793. Land-grips for motor plough wheels.
ela 174 387. Scraper for coulters.
174 404. Cultivator.
174 463. Coulter.
174 861. Plough mechanism.
175 051. Scraper for disc ploughs.
175 374. Harrow.
ce 478 968. Plough with adjustable stilts for various agricultural operations.
155 226. Single-cable, funicular tractor plough.
ærland 73 312. Device for extirpating vine stumps and the like.

(1) See B June 1917, No 578. (*Ed.*)

United Kingdom 104 156. Plough.
United States 1 225 066 — 1 226 754 — 1 227 294. Cotton choppers.
1 225 204 — 1 225 904. Harrows.
1 225 233 — 1 226 793. Disc-ploughs.
1 225 268. Motor plough tractor.
1 225 339. Autoplough.
1 225 367. Harrow-tooth.
1 225 339. Combined mulching and levelling attachment for ploughs.
1 225 400. Levelling and mulching attachment for ploughs.
1 225 423. Agricultural implement.
1 225 659. Cultivator shovel.
1 225 853 — 1 226 450. Cultivators.
1 225 912. Combined tractor, roller and plough.
1 225 949. Coulter.
1 226 200. Agricultural tractor.
1 226 425. Clearing plough.
1 226 493. Tilling machine.
1 226 510. Plough.
1 226 920. Agricultural implement.
1 226 965. Attachment to ploughstock
1 227 089. Ground cultivators.
1 227 166. Rotary weeder and cultivator.
1 227 237. Gangplough.
1 227 349. Reversible plough.
1 227 508. Plough attachment.

Manures and Manure Distributors.

Canada 174 367 — 174 898. Manure spreaders.
Italy 155488. Process for manufacture of a new fertilizer
United Kingdom 105 399. Manure and the like distributors.
United States 1 224 903 — 1 226 736. Manure spreaders
1 225 873. Fertilizer distributor.
1 226 125. Manure loader.

Drills and Seeding Machines.

Austria 73 791. Seeding machine
Canada 714 902. Seed drill.
United States 1 226 797. Grain drill.
1 226 800. Garden seeder.
1 227 018. Planter.

Cultivation.

Austria 73 738. Machine hoe.
France 456 176. Moveable panels for protecting fruit trees against fr
United States 1 224 975. Rotary weeder and cultivator.
1 225 378. Potato-hilling plough
1 225 386. Hoe

Control of Diseases and Pests of Plants.

Austria 73 794. Fly-trap.
73 834. Method and device for destroying vermin
Canada 174 560. Trap.

Reapers, Mowers, and Harvesting Machines.

nada	175 054. Stooker.
	175 092. Drive mechanism for binder reel shafts.
	175 320. Lawn trimmer.
	175 348. Harvester.
ited Kingdom	104 071. Harvesting machines.
	104 165. Lawn mowers.
ited States	1 225 193. Cotton picker.
	1 225 598. Disk guard for grain binders.
	1 225 806 — 1 226 719. Snapping-rolls for corn huskers, pickers, and the like.
	1 225 807 — 1 226 718. Corn Huskers.
	1 226 369 — 1 226 371 — 1 226 373. Grain shockers.
	1 226 376. Binding mechanism.
	1 226 573. Bean-vine gathering apparatus.
	1 226 629. Head holder for grain binders.
	1 227 325. Corn harvester.
	1 227 410. Sharpening attachment for mowing machines.

Machines for Lifting root Crops.

ited States	1 225 759. Beet topper.
	1 225 841. Beet and vegetable topper.

Threshing Machines.

nada	175 170. Tooth for threshing machine.
aly	155 811. Self feeding device for threshing machines.
ited States	1 226 865. Threshing machine.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

nada	174 265. Drying apparatus.
	174 359. Whippletree.
	174 502. Grain door.
	174 572. Feed device for straw cutters.
	174 716 — 174 725. Bag holders.
	175 077. Hay stacking implement.
	175 304. Silo.
itzerland	75 309. Device for covering hay stacks.
	75 310. Device providing for the escape of gas from heated hay.
ited Kingdom	105 626. Drying apparatus.
ited States	1 225 004. Hay rack.
	1 225 031. Grain handling device.
	1 227 058. Hay bunching machine.
	1 227 343. Sheaf loader.

Forestry.

ited States	1 225 432. Brush rake.

Steering and Traction of Agricultural Machines.

ance	483 105. Motor lorry.
ited States	1 227 005 — 1 227 016. Tractors.
	1 227 389. Agricultural tractor.

Housing of Livestock.

France 478 063. New agricultural antiseptic product and process for manufacturing it.
Switzerland 75 308. Process for preparation of maize straw as litter.
United Kingdom 105 525. Insecticides, sheep dips, etc.

Poultry Farming.

Austria 73 835. Poultry feeding device.
United Kingdom 104 413. Poultry feeders.
105 802. Food for poultry, etc.
United States 1 225 063. Chicken brooder and grain sprouter.

Industries Depending on Plant Products.

Canada 175 252. Tobacco leaf stemming machine.

Dairying.

Canada 174 718. Pump for milking machine.
175 133. Butter making machine.
175 311. Churn.
United Kingdom 105 799. Filling bottles, jars, cans, etc.

Farm Buildings, etc.

Canada 174 381 — 174 035. Window ventilators.
174 506. Gate hinge.
175 289. Fence.
175 304. Silo.
Switzerland 75 311. Silo for sweet ensilage.

Miscellaneous.

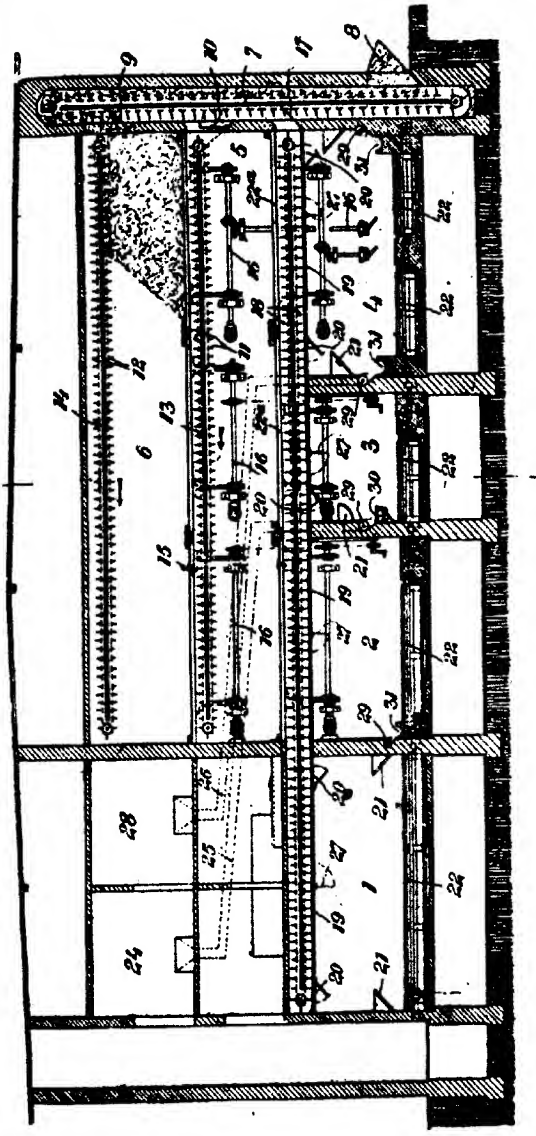
Canada 174 644. Oil feeder.
175 067. Saddle.
175 312. Harness.
175 695. Ice manufacture.
United Kingdom 105 834. Slaughtering cattle.

759 - **Mechanical Installation for a Stable (Naegeli Patent).** — *Le Génie Rural*, Year 9, No. 68, pp. 12-13, figs. 4. Paris, 1917.

The object of this invention is to equip a stable in such a way as to reduce the amount of labour to a minimum. It is particularly intended for carrying food and litter and distributing same among the stores, at the same time removing the manure by means of endless conveyors, elevators, etc.

The essential feature of the invention is that the carriers, bearing claws or teeth of the usual type, are arranged in such a way that the upper belt is situated above the ceiling or roof and the lower one beneath it. The lower belt distributes the food and litter carried up by an elevator; the upper one removes the food placed in the space above. Above the upper belt of the conveyors and in the direction of their movement there are placed a number of moveable bars which, in the raised position, keep the material above out of the reach of the teeth of the conveyors, but when lowered intercept with these teeth in such a way that portions of the material are caught up and carried away.

Fig. 1.



Side view of an installation.

The accompanying figure 1 shows longitudinal section of a stable with an installation at work.

The stalls, properly so called, are situated at ground level and fitted up according to the kind of animal which is to be stabled there. Stall 1 is for sheep, stall 2 for pigs, stall 3 for horses and stall 4 for horned cattle. Above the stables, 2, 3 and 4 are the lofts containing hay or straw. At the end of the stable building is an elevator 7, by means of which the hay or straw is carried up to the loft, the food or litter being conveyed to the elevator by a hopper 8. The teeth of this elevator seize the material and convey it through the traps 9 and 10 of the loft. These traps can be opened or shut at will. In order to prevent the material accumulating around these traps, conveyors on the endless belt system 11 and 12 provided with teeth have been fixed near the ceiling, the upper belt being above and the lower belt beneath, ceilings 13 and 14 respectively. The teeth of the lower belt which are beneath the ceiling and travel in the direction marked by the arrows distribute the material at the bottom of the lofts. In order to prevent the teeth of the upper belt of the carrier 11 catching up the contents of loft 6 while filling loft 5, bars 15, have been fixed above the belt and arranged in such a way that the spaces between the bars are situated above the teeth of the carrier 11 and in the direction of its movement. Each bar can be raised and lowered by means of a winch 16 in such a way that the teeth of the carrier pass through the spaces between the bars of the grating 15, and through the movement of the carrier, carry off the food or litter which is in the loft.

If it is required to carry a portion of the material (hay for instance) from the loft 6 to the mangers, the first thing to do if the loft 6 is full, is to lower the portion of the grating 15 which is situated directly opposite the elevator 7 by means of the winch 16; this done, the carrier 13 is set in motion. The teeth of the carrier will then carry away portions of the lower layer of the material (hay) towards the elevator 7 passing above the traps 10 arranged in the position shown by the dotted line. The elevator lowers the product till it falls over the trap 17 on to the belt 18 which is arranged in exactly the same way as the conveyor 11. Beneath the lower belt of the carrier 18, a ceiling 12 has been fixed with openings 20 closed by trap-doors and through which the material is forced by the teeth of the conveyor 18, the traps mentioned allowing it to fall into the manger 21.

The litter in loft 6 is carried to the various stalls by means of the conveyor 16 and the traps 27 of the ceiling 19, after lowering the gratings 22 placed above the upper apron of the conveyor.

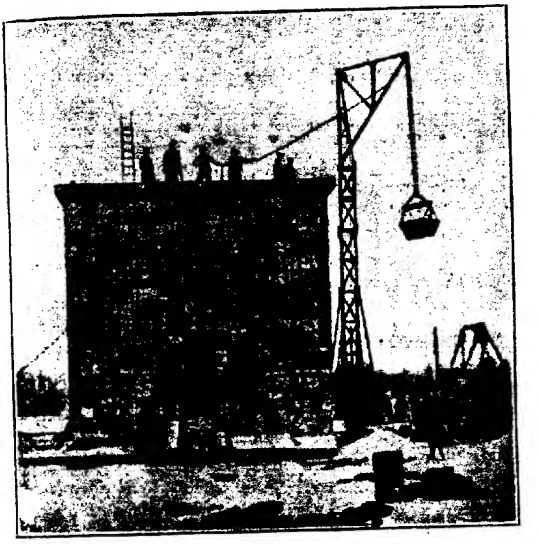
The floor of the stables is formed by the travelling belts 22 in the shape of gratings which carry off the used straw and stable manure to a manure pit. The motion of this belt should naturally be very slow in order to disturb the animals upon it as little as possible. The grain or other feeding stuffs are removed from lofts 28 and 24, where they are prepared or stored, by means of the conduits 25 and 26 joined to funnels placed above the feeding boxes 30 and 31. In these latter revolves a screw which picks up the food and distributed it to the various mangers after their respective traps have

en opened. However, this method of distributing the food is not a part the actual invention.

The whole of the apparatus is driven by electricity and the mechanism n be put out of gear automatically at fixed times.

o - **Reinforced Concrete Buildings.** — ESPIÉALLIER, G., in *Le Génie Civil*, Vol. LXX No. 20, pp. 322-324, 4 figs. Paris, May 19, 1917.

Amongst materials for use in constructing farm buildings, the writer entions reinforced concrete, which has many advantages. Its utility very wide and its price has not become too high ; if metal is required in ie construction, the proportion used can be reduced within reasonable



Construction of a concrete house.

mits so as to form an economical whole. The concrete can be made on ie spot, and often the gravel and sand, which constitute the heavy part i the cement, are to be found close at hand, which reduces the cost of rriage. In addition, concrete construction work can be quickly carried out.

The work can be carried out in two ways : either by moulding on the pot or constructing by members already moulded. Moulding on the spot is he simplest, giving, moreover, a building that has the advantage of being n one piece and offering the greatest resistance.

The large amount of wood required for the moulds represents a serious lisadvantage. Amongst the houses moulded in one piece, the writer men-

tions the HARMS and SMALL "moulded house" ("maison coulé"). The pro
cedure is to pour a special concrete directly into a mould whose metal pan
completely cover the vertical walls, both inside and outside. The floors a
formed by hollow reinforced concrete rafters, prepared previously and la
in position during the construction of the mould. When the moulds a
in place, the concrete is poured in, the concrete maker being mounted a
the top of the wall, so as to give an almost continuous supply without
being needful to change the position of the machine. The cement shou
be sufficiently fluid to penetrate everywhere and to spread in horizontal la
yers. To prevent the heavy materials separating out in the fall from
top of the walls, certain colloidal substances are added to give sufficie
viscosity to the mixture.

By this process, the house can be finished and the moulding remov
in about a fortnight. The chief disadvantage is that the mouldings requ
such a large amount of material. If only one house is to be built, the co
price would be much increased by the cost of carriage of the moulds. Th
method, therefore, seems most suitable for the reconstruction of a villa
or a workmen's quarter, made up of similar houses.

Various contractors have suggested using previously made units of rei
forced concrete to form buildings that could be taken to pieces whe
finished with. The writer describes the system used by the two firms of co
tractors, A. BONNA, and SOULAT, for building houses by means of rei
forced concrete units, the walls being double, which can be obtained b
using reinforced plaster or plaster slabs as a lining unside the house.

761 - **The New Decauville Cement Brick.** — LANORVILLE, GEORGES, in *La Nature*, No. 2
pp. 326-329. Paris, May 26, 1917.

M. DECAUVILLE has invented a new brick already used with success
constructing water-wings, and which will be very useful in constructing ha
buildings cheaply and rapidly. The brick (fig. 1) can be made on the spo
It is made of mortar, little moistened, and composed of sand and cement
It measures about 9 ins. long on the broad face, about 8 ins. on the sm
face, and 5 ½ ins. high; the thickness varies from 3 to 4 ins. in the va
ious types. It is pierced vertically with two ¾ inch holes to receive th
iron wires used for assembling the bricks. Each brick has 2 grooves o
both upper and lower faces. The bricks are made by a rotary pres
delivering about 1 800 bricks in a 10 hour working day, 3 workme
being required.

For building, 3 types of brick are used: 1) sand and cement, 4 inches
thick, weighing 180 kg. to the sq. metre (these bricks can be used, as ha
been done, for building walls 16 in. thick formed of 2 rows of bricks, th
hollow interior being filled with powdered forge-scales); 2) sand and cement
3 ½ ins. thick, weighing 150 kg. per sq. metre for lighter work; 3) forge
scales and cement 3 ½ ins. thick, weighing 105 kg. per sq. metre. The
lighter bricks are suitable for building partition walls.

Iron wire of 1/5 inch gauge is used in assembling the bricks. The wir
is cut in lengths being multiples of from 4 to 7 times the height of the brick

the wires are placed in the holes of the bricks as the wall gradually rises. Two wires of the same length should never be placed together. A wall of extreme solidity and rigidity is thus constructed in a remarkably short time. The 2 grooves on the upper and lower surfaces of each brick may be filled with a light mortar or used to contain iron wire to join the angles

New DECAUVILLE *Cement Brick.*

Fig. 1.

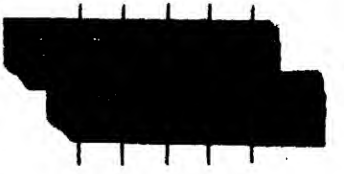


Fig. 2.

where a 6 inch iron standard can be fixed to the posts placed for the woodwork or openings. The angle bricks can be replaced by angle-blocks made in special moulds.

The special form of this easily-made brick, its low cost and its many applications, appear to justify its existence.

RURAL ECONOMICS.

62 - **Labour Requirements of Crop Production.** — COOPER, T. P., PECK, F. W. and ROSS, A., in *The University of Minnesota Agricultural Experiment Station, Bulletin* No. 157 (Division of Agronomy and Farm Management), pp. 1-55. University Farm, St. Paul, Minnesota, March, 1916.

The cost of producing farm products under actual farm conditions has been studied at the University of Minnesota Experiment Station for more than 10 years (1). The data thus obtained have been used to determine the actual labour requirements of farm crops in terms of man and horse

(1) Cf. HAYS, W. M. and PARKER, E. C., The Cost of Farm Products, in *U. S. Dept. of Agriculture, Bureau of Statistics, Bull.* 48, and *Minnesota Experiment Station Bull.* 97, 1906.

PARKER, E. C. and COOPER, THOMAS, The Cost of Producing Minnesota Farm Products, *U. S. Dept. of Agriculture, Bureau of Statistics, Bull.* 73, and *Minnesota Experiment Station Bull.* 117, 1910.

COOPER, THOMAS, The Cost of Minnesota Dairy Products. *U. S. Dept. of Agriculture, Bureau of Statistics, Bull.* 88, and *Minnesota Experiment Station, Bull.* 124, 1911.

PECK, F. W., The Cost of Producing Minnesota Farm Products, 1908-1912. *Minnesota Experiment Station, Bull.* 145, 1915.

hours per acre and to define some of the principles underlying the use of man labour on the farm, so as to furnish a basis which will allow a better estimation of the cost of production.

The data refer to 8 farms at Northfield, Rice County for the south-eastern part of the State, 8 at Marshall, Lyon County, for the south-western part, and 8 at Halstad, Norman County, for the northwestern part; a large grain farm of 1920 acres in Norman County was also included. When the cost of production studies were started in 1902, the number of farms chosen in each of the above-mentioned districts was 15, but this number was subsequently reduced to 8 in each locality. The Northfield group includes very different types of farms with dairy products as the principal source of livestock income. They average about 175 acres and are considered typical farms in production and operation.

The land is rolling but well-drained, of friable loam with a clay subsoil, and responds readily to cultivation. The farms of the Marshall group are larger, averaging about 325 acres with but slight variations in area. The livestock income is derived chiefly from beef cattle and hogs, with some cows and sheep. The land is practically level, broken by sloughs and pot holes. The soil is easily worked loam, 4 horses doing as much as 5 at Halstad. The Halstad farms have an average area of 300 acres. The soil is a heavy clay loam. At one time, grain was grown here, but, during the period of the studies, a rapid transition to dairying and hog raising took place. The large farm of 1 020 acres was primarily a grain farm with practically no income from livestock.

Table I shows the average acreage of each crop in the 3 groups of farms:

TABLE I. — *Acreage of each crop.*

Crop	Northfield group 8 year average *Acres*	Marshall group 5 year average *Acres*	Halstad group 8 year average *Acres*
Wheat	6.7	33.3	92.7
Oats	55.1	43.5	25.6
Barley	9.2	32.2	36.2
Succotash	7.1	—	—
Flax	—	—	10.6
Corn	28.1	52.9	12.8
Hay	23.2	45.9	44.2
Pasture	33.8	60.4	51.7
Minor crops	5.3	12.8	6.1
Garden	1.5	1.0	1.2
Farmstead	2.0	5.3	6.2
Waste	3.5	34.0	17.1
Total	176.4	324.2	301.7

Table II gives the type of livestock on the farm.

TABLE II. — *Average number of livestock per farm.*

Livestock	Northfield	Marshall	Halstad	1920-Acre farm.
Horses	6.9	10.2	8.9	48.5
Cows	13.0	10.1	8.8	8.5
Miscellaneous cattle	12.1	16.7	11.7	15.4
Swine	16.1	32.7	5.1	16.8
Poultry	118.4	127.6	88.3	110.0
Sheep	60.5	55.5	25.7	—

USE OF LABOUR. — The productivity of labour may be increased in 4 ways : 1) by organis- g the farm so that labour may be used productively thoughout the year ; 2) by improving e yielding power of the soil by crop rotation or by the application of fertilisers and manures ; by maintaining more productive kinds of livestock so as to use labour profitably during the onths when crop labour is not demanded ; 4) by using large machines and mechanical power as to increase the amount of work performed by each unit of labour. Whereas this last method generally adopted by farmers in the north-west of the United States, the first 3 have not yet en put to so much use as they should in the eventual increase of the productivity of labour.

An examination of the average maximum and minimum number of hours of work done by e man during the different months of the year in the 3 groups, from 1905-1912, shows that, Northfield, the greatest deviation from the average (12 %) is in February, while, from pril to October, there is approximately only 40 hour's difference per month.

At Halstad, on the other hand, the deviations between the active and inactive months mount to 52 hours a month per man. The general averages show that the nominal amount labour to be expected from a man per month is about 300 hours, including crop and livestock bour.

Table III gives the distribution in labour in percentages in the 3 groups of farms, for crops, estock, horses and miscellaneous labour.

TABLE III. — *Distribution of labour of man and horses in the 3 groups.*

	Northfield		Marshall		Halstad		1920-acre farm	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
rop	30.4	75.8	44.3	79.9	39.7	83.7	48.4	84.2
oductive Livestock .	37.2	6.8	25.3	5.5	27.6	4.0	10.0	0.5
ork Horses . . .	9.0	5.7	11.8	2.0	15.2	2.1	20.1	2.4
liscellaneous . . .	17.4	11.7	18.6	12.6	17.3	10.2	21.5	12.9
Total . . .	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The total number of working hours of men and horses during the various months of the ar is summarised in Table IV (The authors also give the distribution per crop, for livestock, ermanent improvements, maintenance, and household and personal requirements).

As these data on the number of working hours per man and per horse represent an average f 5 years, they may be considered as being uninfluenced by seasonal changes, and may be pplied to all districts where farms are worked on similar lines. In the Northfield group 6330 ours of labour are required annually. If the proprietor himself does 3453 hours annually here remain 2777 to be performed either by hired labour or by a member of the proprietor's ousehold.

The effects of the single-cropping system on the yearly distribution of labour is well illustrated by the special grain farm. On this farm 2347 hours of labour requiring 8 men are necessary in the 2 spring months, in August, 4191 hours and 13 men are necessary, whereas in September and October an average of 12 men is necessary. August, September and October require 58 % more labour than April and May. A similar increase is demanded from the horses. In the Northfield farms this increase is only 19 % for men and almost nil for horses. The Halstad farms, which also tend towards single cropping, show an increase of 30 %. Taking into consideration the number of hours devoted to crops, the percentages given in Table V are obtained ; these show the amount of time each labourer can devote to crops.

TABLE IV. — (*Average for* 1905-1912). *Total hours of labour performed by men and horses per farm per month, in the* 3 *groups.*

Month	Northfield		Marshall		Halstad		1920-Acre farm	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse
January	345.8	132.5	340.5	164.8	360.8	150.4	513.8	153
February	336.4	131.7	346.3	173.9	358.0	146.5	488.8	154
March	423.4	211.3	467.9	340.2	442.8	137.6	809.1	492
April	583.7	633.6	505.8	775.4	578.3	731.9	2 443.1	3 592
May	577.4	622.8	613.9	917.6	637.8	881.0	2 251.4	4 964
June	605.8	479.6	661.3	706.1	620.5	578.4	2 355.4	3 302
July	665.9	556.6	773.0	871.5	805.1	744.6	2 753.0	3 012
August	719.7	636.2	838.9	1 016.0	890.6	1 097.1	4 191.3	6 549
September	569.8	576.4	682.6	935.5	768.2	1 233.1	3 560.2	7 221
October	604.2	584.9	639.8	879.8	714.7	1 107.0	3 359.6	7 169
November	516.5	417.0	581.9	701.6	516.7	372.3	1 947.5	2 730
December	384.6	171.4	419.6	305.2	370.5	142.0	527.0	113
Total	6333.2	5 154.0	6 931.5	7 181.8	7 063.9	7 321.9	25 200.0	39 433

During July, August, September and October about 50 to 75 % of the total labour may be given up to crops. In grain-growing districts where dairy cows are kept, winter milking is an advantage.

On diversified farms, during August and September, about 55 % of the labourer's time is given up to crops. On the specialised grain farm this figure rises to as much as 81 % in September. During the spring months a corresponding difference is noted, due partly, on the mixed farms, to a greater proportion of labour being devoted to livestock, whereas, on grain farms, the labour not taken up by crops is used in the care of the horses and general upkeep of the farm. On the 1920 acre farm, 67 % of the labour devoted to livestock is employed in the care of work horses, which, though maintained exclusively for productive enterprises, are not themselves directly productive. On the Halstad farms this percentage is only 35.3 %, on the Marshall farms, 31.8 %, on the Northfield farms only 19.5 %.

TABLE V. — *Hours per man devoted to crops, and relation of crop labour to total labour performed.*

Month	Northfield average of 64 farms		Marshall average of 41 farms		Halstad average of 58 farms		1920-Acre farm
	Available hours	Per cent. of total	Available hours	Per cent. of total	Available hours	Per cent. of total	Per cent. of total hours available
April	117	38	121	42	113	39	42
May	108	36	129	43	114	37	53
June	81	27	106	39	87	39	43
July	150	50	172	57	116	54	49
August	174	55	193	63	205	65	75
September	152	52	165	56	109	64	81
October	151	49	141	50	148	47	45

BLE VI. — *Hours per acre required from men and horses in the 3 groups for producing spring wheat in soil ploughed in autumn* (1).

Operation	Northfield 7 year average		Marshall 7 year average		Halstad 10 year average	
	Hours per acre		Hours per acre		Hours per acre	
	Man	Horse	Man	Horse	Man	Horse
ughing	3.71	10.47	2.89	10.74	2.48	11.18
nuring	2.12	3.95	1.81	3.92	0.96	1.84
ding seed	0.12	0.20	0.09	0.19	—	—
ining seed	0.32	—	0.28	—	0.27	—
rowing (2)	1.20	2.59	0.42	1.55	0.72	2.71
king (3)	0.76	2.26	0.69	2.69	0.70	2.81
ding	0.66	1.98	0.59	2.18	0.65	2.53
tting	1.04	2.99	0.86	3.05	0.87	3.05
cking	1.21	—	0.97	—	1.03	—
ck threshing	2.51	2.66	2.79	4.24	2.13	3.32
chinery	0.36	0.10	0.31	0.15	0.36	0.10
neral expenses	0.45	0.80	0.51	0.70	0.60	0.71
Total	**14.47**	**28.00**	**12.21**	**29.41**	**10.77**	**28.25**
cking	2.35	2.39	2.46	3.28	2.24	2.52
ck-threshing (4)	2.42	1.02	1.20	1.17	1.46	0.69

Supplementary Data	Northfield	Marshall	Halstad
eld per acre (bu.)	15.04	13.22	16.04
ed per acre (bu.)	1.68	1.30	1.24
ine per acre (lbs.)	2.23	2.70	1.93

(1) Data based on 388 acres of wheat at Northfield; 2 900 at Marshall, 8 857 at Halstad.
(2) The seed-bed was harrowed 2.3 times at Northfield; 1.2 times at Marshall and 1.7 times at Halstad.
(3) The seed-bed was disked 1.4 times at Northfield; 1.1 times at Marshall and 1.3 times at Halstad.
(4) 219 acres at Northfield; 1 860 acres at Marshal; and 2 230 acres at Halstad.

If the total percentage of labour devoted to productive work be considered, 73.6 % will found under the conditions of mixed farming, 69.6 % in the Marshall group and 67.5 % in e Halstad group, as against 58.4 on the grain farm. Extremely well organised and highly ersified farms may devote as much as 80 % of their total labour on productive enterprises.

Most of the farms in Minnesota come into one of these 4 groups; the predominance of certain factors tends to give advantage now to one, now to the other. The data given, if properly controlled, may serve as a basis for any kind of labour on Minnesota farms.

LABOUR REQUIRED FOR VARIOUS CROPS. — In order to supply exact data on the requirements of various crops with regard to man and animal labour, the averages, taken over several ars, for each crop are given. The figures refer to the following crops: — spring wheat, corn, ts, barley, rye, flax, potatoes, mangels, hay, timothy seed, clover seed, millet and hemp. bles VII and VIII summarise the figures bearing on the total number of working hours per re of men and horses required by each crop in the 4 farm groups, both individually and as a neral average, as well as their monthly distribution throughout the year for the Northfield

TABLE VII. — *Average annual hours of labour per acre required in producing field crops* (1902-1911).

Crop	Northfield Rice County		Marshall Lyon County		Halstad Norman County		Glyndon Clay County		Average of all farms	
	Hours per acre		Hours per acre		Hours per acre		Hours per acre		Hours per acre	
	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse
Wheat, (shock-threshed)	14.5	28.0	12.2	29.4	10.8	28.2	—	—	[illegible]	[illegible]
Oats (shock-threshed)	14.7	28.2	12.2	30.0	11.7	29.6	—	—	[illegible]	[illegible]
Barley (shock-threshed)	14.8	27.9	13.3	31.4	11.9	29.5	—	—	[illegible]	[illegible]
Autumn rye (shock-threshed)	—	—	10.2	27.0	10.4	27.5	—	—	[illegible]	[illegible]
Flax (stack-threshed)	15.0	31.0	15.6	40.2	12.9	32.6	—	—	[illegible]	[illegible]
Corn (husked)	30.1	53.6	22.6	51.6	30.9	57.6	—	—	[illegible]	[illegible]
Fodder corn (cut, shocked and stacked)	33.7	54.1	25.0	51.0	33.1	52.8	—	—	[illegible]	[illegible]
Ensilage	33.7	56.0	—	—	31.5	63.5	—	—	[illegible]	[illegible]
Potatoes (machine production)	—	—	—	—	—	—	44.4	75.0	[illegible]	[illegible]
Mangels	—	—	—	—	—	—	180.7	99.3	[illegible]	[illegible]
Hay, timothy and clover, 1st. crop	12.7	11.8	11.0	13.4	12.6	13.8	—	—	[illegible]	[illegible]
Hay, timothy and clover, 2 cuttings	21.3	20.3	15.6	23.0	—	—	—	—	[illegible]	[illegible]
Hay, wild	9.1	10.0	11.2	13.5	13.5	20.7	—	—	[illegible]	[illegible]
Timothy, cut for seed	—	—	9.0	8.8	4.4	6.1	—	—	[illegible]	[illegible]
Clover, cut for seed	10.1	11.3	8.1	13.6	—	—	—	—	[illegible]	[illegible]
Hay, millet	18.5	36.3	16.9	30.1	17.3	32.5	—	—	[illegible]	[illegible]
Hemp	14.3	27.4	—	—	—	—	—	—	[illegible]	[illegible]

and Halstad farms. Table VI gives details concerning the cultivation of spring wheat in the 3 groups, in order to illustrate the analytical scope of the facts collected.

The Northfield group of farms yielded a bushel of wheat with 56 ½ minutes of human labour and 101 ½ minutes of horse labour, not including the labour of threshing. When separators of large capacity are used, 7 ½ minutes of human labour are required to thresh a bushel of wheat. If the separator be smaller the time may be increased to 10 minutes per bushel. Stack threshing with machines of exceptionally large capacity, it may be reduced to 5 minutes. Stack threshing with machines of average capacity requires 3 ½ to 4 minutes of human labour per bushel. If Minnesota farms are to compete successfully on the international wheat markets, they must increase their unit of production. By good systems of production the labour cost of a bushel of wheat may be reduced from by 25 to 40 %, thus, although more labour per acre is employed, the production unit may be increased from 50 to 100 % by crop rotation and fertilising. The Halstad farms show the extent to which a man's labour may be reduced by the use of machines drawn by 4 horses, or even more, per man ; by these means there is an approximate reduction of 4 hour's human labour per acre. Further increase in the productivity of labour must be obtained either by additional labour, or by increased fertility of the soil.

Table VII, which shows the total average hours of labour of men and horses required for the various crops, proves that, for small grains, there is a fairly constant ratio of horse-labour to man labour. This ratio is approximately 2.4 : 1 in the small grains, 1.8 : 1 in the cultivated corn crop and 1 : 1 in the hay crop.

RELATION BETWEEN COST OF LABOUR AND TOTAL COST OF CROP PRODUCTION. — The study of the labour cost and production cost has shown that, in the Northfield group the labour cost of producing wheat is $ 4.82 per acre, or 36 % of the total cost, and, in the Halstad group

	Crop	March		April		May		June		July		August		September		October		November		Total	
		Hours		Hours		Hours		Hours		Hours		Hours		Hours		Hours		Hours		Hours	
		Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse	Man	Horse
Northfield	Wheat	2.0	5.0	1.5	2.1	—	—	—	—	2.0	3.2	2.2	2.2	2.3	4.1	4.0	10.8	—	—	14.0	27.4
	Oats	0.2	—	1.9	5.4	—	—	—	—	2.2	3.2	1.2	1.1	2.3	4.1	6.0	13.7	—	—	13.8	27.4
	Barley	0.5	—	1.4	4.4	—	—	—	—	2.1	3.0	3.1	3.2	2.3	4.1	4.9	12.1	—	—	14.3	27.4
	Flax	—	—	0.4	—	4.0	10.2	—	—	—	—	4.4	7.3	2.2	3.7	3.9	19.7	—	—	14.9	30.9
	Field-corn, cut	0.6	—	—	—	3.5	10.5	8.0	12.9	—	—	—	—	6.5	9.0	3.9	10.1	14.9	19.4	38.0	61.9
	Corn fodder	—	—	—	—	4.0	13.5	5.1	9.0	—	—	—	—	10.5	11.2	3.9	10.1	8.3	9.4	32.4	53.2
	Corn silage	—	—	—	—	4.7	13.7	5.4	9.1	—	—	—	—	10.4	21.3	4.0	10.3	—	—	23.3	36.4
	Hay, 1st. cutting	—	—	—	—	—	—	—	—	12.7	11.7	—	—	—	—	—	—	—	—	12.7	11.7
	Hay, 2nd. cutting	—	—	—	—	—	—	—	—	—	—	8.4	8.5	—	—	—	—	—	—	8.4	8.5
	Wild hay	—	—	—	—	—	—	—	—	9.0	10.4	—	—	—	—	—	—	—	—	9.0	10.4
	Millet	—	—	—	—	—	—	4.2	12.0	1.6	3.1	5.0	4.9	2.6	4.	4.9	11.8	—	—	18.9	36.5
Halstad	Wheat	—	—	2.0	8.9	—	—	—	—	—	—	2.0	3.2	4.5	7.0	2.7	11.5	—	—	11.2	30.6
	Oats	—	—	2.5	7.8	—	—	—	—	1.9	3.0	2.3	3.1	2.1	2.9	2.7	12.9	—	—	11.5	29.7
	Barley	0.4	—	—	—	3.2	12.0	—	—	1.8	3.1	—	—	3.5	4.3	2.9	10.5	—	—	12.3	29.9
	Rye	—	—	—	—	—	—	—	—	4.0	3.1	2.7	6.2	3.0	6.5	2.8	12.3	—	—	10.5	28.1
	Flax	0.6	—	—	—	2.5	12.7	—	—	—	—	—	—	5.4	7.9	4.3	11.9	—	—	12.8	32.5
	Field-corn, cut	—	—	0.3	—	3.3	12.0	9.3	13.6	—	—	—	—	5.0	6.7	2.7	12.1	31.6	16.4	32.4	60.8
	Corn fodder	—	—	—	—	3.2	11.2	6.0	8.3	—	—	—	—	10.0	19.5	3.5	13.0	—	—	31.7	51.8
	Corn silage	—	—	—	—	3.0	10.1	2.8	5.4	—	—	—	—	22.4	33.1	3.5	15.1	—	—	31.7	63.7
	Hay, 1st. cutting	—	—	—	—	—	—	—	—	12.6	3.8	—	—	—	—	—	—	—	—	12.6	13.8
	Wild hay	—	—	—	—	—	—	—	—	12.8	20.8	—	—	—	—	—	—	—	—	12.8	20.8
	Millet	—	—	—	—	4.4	16.5	—	—	—	—	10.6	10.5	1.1	1.0	2.8	11.2	—	—	17.9	40.1

$ 4.49 per acre, or 43 % of the total. In this last group the higher cost of labour is due to lower charges for land rent, machinery, etc. The average for the 3 groups of farms studied are 49.8 % of total cost for fodder-corn production, 54.5 % for ear-corn, 50.9 % for hay, 36.4 % for flax, 31.3 % for wheat, 36.5 % for oats, 31.1 % for barley and 30.2 % for rye.

The differences between the labour required under mixed farming conditions and single cropping conditions are surprisingly small. These differences are determined largely by the size of machinery and the number of horses used per man. The size of the field, so long as it does not prevent the use of equal sized machinery, has a very slight influence. A farm of 1/4 acres, or even less, if the fields are properly arranged, may grow a crop with no more labour per acre than is required on a farm of from 400 to 600 acres with fields of larger size. The fact that, in the Marshall group, corn requires approximately 7 hours' less labour per acre, is due rather to the greater efficiency of the workers in the husking rather than to any difference in the size of fields and of machinery used. This seems to show that the change of an agricultural system in a given district, from the production of a single group of crops on large farms to mixed farming on a scale less extensive, yet large enough to allow the use of a team of 4 or 5 horses, may be brought about without necessitating an increase in the labour required for crop production. The principal problem to be solved is the distribution of work during the year so that the different operations to be carried out during the same period shall not clash, for, should this happen, the whole organization of the farm, and, consequently, that of the desired change is compromised. In the north-western states, for example, the cutting of the first crop of alfalfa usually coincides with the cultivation of the corn. In this case, either additional labour must be employed, or else the average under alfalfa must be reduced so as not to interfere with the cultivation of the corn crops. Similarly, the harvesting of corn for silage falls at the same time as the threshing of the grain crops, etc.

The distribution of work for the principal crops throughout the year (Table VIII) gives valuable information on this point. The figures given are the averages for 8 years, and in most cases are exempt from the special influence of the seasons in each of these years.

A detailed study of the number of hours required for marketing the products and for threshing terminate the paper.

763 – **Labour Requirements of Dairy Farms as Influenced by Milking Machines.**

HUMPHREY, H. N., in *U. S. Department of Agriculture, Bulletin* No. 423 (Professional Paper by the Office of Farm Management), pp. 1-18. Washington, November 25, 1916.

This bulletin gives the results of a series of studies on the organization of dairy farms, undertaken to determine the influence of the introduction of milking machines on the amount and distribution of labour on such farms.

The data were obtained from 109 New York dairy farms, 56 of which were using mechanical milkers, and from 160 farms in Ohio, Michigan and Illinois, 100 of which were using milking machines. Whereas, on the New York farms, dairy produce represented 90 % of the total business, on the other farms labour was largely devoted to general farming.

The principal facts obtained are as follows:

The time gained by mechanical milking increases with the number of dairy cows in the herd. In herds of 15 cows or less, the average time required to milk one cow by hand is more than 7 minutes, and the corresponding time by machine less than 5 minutes. In herds of more than 50 cows, the average time for hand-milking is a little less than 7 minutes, for machine milking 4.15 minutes. In herds of more than 50 cows one man can milk 28 cows by machine, whereas, by hand be can only milk 17.

The cost of hand milking changes but little with an increase in the herd whereas that of machine milking decreases rapidly.

The average annual cost of milking a herd of 15 cows by hand is $10.91 r cow; in herds of 50 cows this cost is $10.45. In the first case mechani- l milking costs $11.77, in the second, $7.34.

This does not mean that, in herds of less than 15 cows, mechanical milk- g is more expensive than hand milking. On 32 farms with less than 15 ws, machine milking allowed an annual economy of $2.63 per cow as the sult of labour saved.

The appended table gives a summary of the labour employed on farms ilking by hand and those milking by machine in the states of New York, ichigan, Ohio and Illinois. The total area and the labour devoted an- ially to crops (i. e. not including the meadows) are taken into considera- n).

Farms without milking machines.

State	Number of farms	Average size (acres)	Number of men employed per farm per acre	Acres of crops raised per farm	Acres of crops per man	Number of dairy cows per farm	Number of dairy cows per man
ew York.	53	191.4	2.16	73.8	34.2	30.8	14.3
ichigan, Ohio, Illinois	60	146.7	2.14	90.75	42.4	20.5	9.6

Farms with milking machines.

ew York.	56	213.9	2.12	71.4	33.7	34.9	16.5
ichigan, Ohio, Illinois	100	166.4	2.22	98.3	44.3	23.7	10.7

The Michigan, Ohio and Illinois farms have a larger proportion of creage under crops than many of the New York farms. They raise more tops per man employed and keep fewer dairy cows. From the point of iew of the labour employed they are better organized than the New York airy farms. Moreover, owing to the lack of good milkers and the high ages demanded, mechanical milking is of great importance on these farms.

54 - The Theory of Correlation as Applied to Farm Survey Data on Fattening Baby Beef. — TOLLEY, H. R., in *U. S. Dep. of Agric., Bulletin* No. 504, Professional Paper; Office of Farm Management, pp. 1-14. Washington, May 23, 1917.

This paper sets forth the results of an experiment in applying the heory of correlation, hitherto used chiefly in the analysis of biological, ociological, psychological, and meteorological statistics, to the study of ome of the data of the office of Farm Management (1).

The material for the investigation was obtained from 67 records, ta- en, during the years 1914 and 1915, from farmers of the cornbelt, who ere fattening baby beef for market (2). The factors considered were:

(1) Cfr. *B.* No. 1316, December 1916.

(2) Cfr. Report III, Office of the Secretary 1916 and *B* June 1917., No. 583 (*Ed.*).

The profit or loss per head, the weight, value per hundredweight, value of feed consumed per head, cost at weaning time and date of sale. Coefficients of correlation were computed for every pair of these factors and used as a measure of the relationship existing between them.

This application of the theory of correlation to the data on fattening baby beef animals showed:

1) That for the herds considered, the cost of producing the calves and carrying them until weaning time was by far the most important factor in determining the profit;

2) That there was no connection between the cost at weaning time and any of the other factors, for the calves which were produced cheaply were seemingly just as good feeders and brought just as good a price per pound as the more expensive ones;

3) That the weight at which the calves were sold and the date of sale had very little effect on the profit, except for the fact that in the two years of the records the price was higher in the latter part of the summer at the time when the heavier calves were put on the market;

4) That the calves which consumed the heaviest ration sold at higher prices than the others, but did not return a correspondingly greater profit as the advanced price scarcely offset the extra value of feed consumed.

AGRICULTURAL INDUSTRIES.

705 – **A New Apparatus for Pasteurising Wine in the Cold.** – MERZ, F. L., in *Allgemeine Wein-Zeitung*, No. 21, p. 165, 1 fig. Vienna, May 24, 1917.

There are no filters which can remove the bacteria and moulds from wine, the reason being that the filter-pores are too large. Thus, if it is required to remove the microflora from wine, pasteurisation must be used, which results in impaired quality of the wine.

A New Apparatus for Pasteurising Wine in the Cold.

The writer has invented a new filter which retains the organisms and thus permits of pasteurising without heating: it consists of a fairly large number of porcelain cells ("Filterzellen" or "Filterkerzen") with pores so fine that the bacteria are retained. The quantity of wine filtered is not very large, being 17.6 to 132 gallons per day for a filter consisting of 10 to 30 cells; the daily yield of a cell is thus 3.63 gallons, on an average. To obtain satisfactory results, the wine should not be turbid, should not contain many impurities and should contain carbonic acid gas at a pressure of from 0.5 to 1.5 atmospheres.

The process is, therefore, most suitable for sparkling wines and those of fine quality. It does not give a sufficient daily yield, but the writer hopes to modify the apparatus so as to obtain a higher yield. In any case, the apparatus marks an advance in wine-making.

706 - **The Use of Metabisulphite of Potassium and Sodium in Wine-making.** — CARLES, P. in the *Bulletin de l'Association des chimistes de sucrerie et de distillerie de France et des Colonies*, Vol. XXXV, Nos. 4 6, pp. 143-145. Paris, October-November-December, 1916.

As the greater part of the potassium salts come from German mines they have had to be replaced, in the allied countries, by sodium salts, and, in wine-making, potassium metabisulphite is replaced by sodium metabisulphite. Although pure sodium metabisulphite contains 67.2 % of sulphur dioxide, it is not so satisfactory as potassium metabisulphite which only contains 57.6 %.

Sodium metabisulphite is sold in powdered or compressed form, since it does not crystallise ; it therefore presents a larger surface to the air than does potassium metabisulphite. This reduces the strength and causes it to lose its acid relatively quickly. Moreover, in the powdered form it is more subject to adulteration.

Wine, as a rule, contains sufficient tartaric acid to precipitate the potassium, but when sodium is used, soluble acid tartrate of soda is formed, leaving an excess in the ash.

Sodium metabisulphite is rarely free from iron. When sodium metabisulphite containing iron is poured into white wine, the wine, after a few months, turns dirty grey, gradually changing to black. This is due to the formation of ferric tannate by the action of the iron on the tannic matter in the wine.

Sodium metabisulphite keeps better bottled as a saturated solution than as powder. The commercial solution is colourless, with a distinct burnt sulphur smell. According to whether it is prepared in winter or in summer its density is 1.300 or 1.350, or 35° Baumé, values corresponding to 390 gr. of sulphur dioxide per litre.

To avoid contaminating the flavour by the use of sodium metabisulphite it is necessary to know : 1) the amount of suphur dioxide it contains ; 2) the amount of iron it contains.

The first test made with iodine, should be done by an expert. The second test may be easily carried out as follows : — About 20 gr. of bisulphite solution are poured into a porcelain dish and as much nitric acid, gradually added, as is required to free the sulphur dioxide. This is evaporated and heated till it begings to melt. If the mixture turns a more or less brown ochre colour iron is present. As control the mixture should be left to cool, dissolved in warm dilute hydrochloric acid and saturated with an excess of ammonia. The iron separates out as loose flakes of oxide and may be estimated by the use of an ordinary filter.

The same method may be used for the powder, 10 gr. of which should be moistened with about an equal quantity of water.

767 - **The Use of Apples in Grain Distilleries.** — LINDET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 26, pp. 710-712. Paris, July 11, 1917.

Owing to the promising apple crop this year in France, attention is being directed to their utilisation for distilling.

In 1915 apples had been distilled with beets (1) (the mixture containing 10 to 20 % of apples), but the results were unsatisfactory. The apples cannot be cut with the same shaped knife as the beets; the temperature required by the beets is too high for the apples, which go to pulp, thus preventing the circulation of the juice, the apples do not contain sufficient nourishment for the yeasts; the mixture of apple and beet juices ferments badly because the yeast required by one predominates over that required by the other.

The author points out that the slowness of the fermentation of apples is due to the lack of nutritive substances, and that these substances (ammonium sulphate, phosphate, etc.) are most expensive and difficult to obtain. It is, therefore, most advisable to use the apples as juice, as grated pulp, or even as boiled pulp, in the presence of grain treated with acid or malt, as the grain contains nutritive substances in excess of those required by the yeast. It is possible to add to a given weight of maize 3 and 4, or even more times its weight of apples.

768 - **Home-Made Beet Syrup as a Substitute for Sugar.** — TOWNSEND, D. C. and GORE, H. C., in *United States Department of Agriculture, Farmers' Bulletin* 823, pp. 13, fig. 10. Washington, May 1917.

The authors describe a method for the manufacture of beet sugar (Patent No. 1 555 806 of October 5th., 1915).

The beets are carefully cleaned by soaking for a few minutes and then washing with a brush. A barrel is placed upright and the beets finely sliced with a sharp knife on the barrel, so that the slices fall inside. Boiling water is then immediately poured over the beets so that they are well covered. The barrel is then covered, wrapped in a cloth folded many times, and left for an hour; from time to time it is shaken without being uncovered. The liquid is then filtered through a cloth or run out through a tap in the cask. The filtered liquid is then evaporated over an open fire till it becomes syrupy. Thirty-five litres of beet give 70 litres of slices which are covered with 38 litres of boiling water. The slices are not crushed after maceration; as they still contain a little sugar they make an excellent food for poultry, pigs, etc. The scum which rises during heating must be carefully removed, by this means the syrup loses the disagreable taste of the beets. The syrup, while still hot, is put into boxes or bottles, which are carefully closed up so as to prevent the formation of moulds.

769 - **Method of Bread-Making with Previously Soaked Grain.** — LINDET, in *Comptes Rendus de l'Académie d'Agriculture de France*, No. 18, pp. 508-513. Paris, May 16, 1917.

The French Department of Agriculture nominated a special commission to study the method of bread-making tested at Bergamo (Italy) (1). The

(1) See *B.*, July 1917, No. 668. (*Ed.*)
(1) " 1916, No. 679. "

mmission used good Australian wheat and medium La Plata wheat. Half each wheat was ground, all the products mixed and worked in the usual ay. The other two halves were heated by the Italian method, and all ie bread cooked in the same oven. The bread made with soaked wheat id that made with ground wheat differed very slightly in appearance. As gards taste the results were as follows :

No. 1) Australian ground wheat : slightly unpleasant.

No. 2) Plata ground wheat : marked taste of bran making it slightly ur.

No. 3) Australian soaked wheat : sour.

No. 4) Plata soaked wheat : unpleasant.

Whole-meal bread made with ground grain is superior to whole-meal ead with soaked grain. This latter method can only be used with well-eaned and well-washed wheat.

o - **Utilisation of Rotten Potatoes in the Manufacture of Starch.** — I. Observations de M. DUCOMET. — II. Remarques de M. GIRARD A. Ch. in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 26, pp. 716-719. Paris, July 11, 1917.

I. — Spoiled potatoes are in general use for starch-making when decomposition has not gone very far, but when actually rotten they are rown on the manure heap. M. SCHRIBAUX, when reading to the Academy short paper by M. DUCOMET, remarked that this worker's observations ave shown that even when tubers are in a deliquescent state, the starch still undecomposed ; liquefaction of the starch only takes place very late. is therefore advisable to collect all potatoes attacked by damp rot whatver the initial cause of this may be (frost, mildew or other organisms), and o extract the starch. This latter, when properly sterilised, is suitable r consumption by man as well as by animals.

It is interesting to note that the period of treatment of the damaged otatoes can be considerable prolonged by keeping them water, this latter ien being periodically changed.

II. — M. A. CH. GERARD remarks that about 75 % of the nitrogen and) % of the potash contained in the tubers is carried off in the water in hich they are washed. These substances are worth utilising ; this though fficult commercially should be easy on the farm. The most simple proess consists in absorbing the residuary water by a heap of manure, comost or even by earth. A better process consists in bringing the water to ie boiling point. The half of the nitrogen which is in the albuminoid state ould be congealed and the nitrogenous coagulum could be used almost ire for feeding stock ; the other half of the nitrogen as amides and the mieral elements remaining in the water would go to the manure or to the il.

1 - **Some Observations upon the Relation of Humidity to the Ripening and Storage of Fruits.** — SHAMEL, A. D., in *The Monthly Bulletin of the California State Commission of Horticulture*, Vol. VI, No. 2, pp. 39-41. Sacramento, California, February 1917.

These experiments and observations of the effect of different conditions relative humidity upon the ripening and curing of lemons held in storage,

have been conducted in the National Orange Company's lemon storage and packing house at Corona California. In this building there are twenty rooms, each containing about 8000 cubic feet of space, in which a reasonably effective control of the conditions of temperature and relative humidity has been secured by means of ventilation, steam heat and special humidifiers.

In an experimental curing of a roomful of lemons, with the room maintained for four weeks at about 90° F. and about 90 per cent. relative humidity, more than 90 per cent. of the cut stems of the fruits callused over perfectly in the same manner as is the case with cuttings under favourable conditions. This was the first time when any such large proportion of the fruits developed this callous.

In further experiments it was discovered that the development of the calloused condition depended largely on the maintenance of a uniform condition of relative humidity and that the callous developed more rapidly under a high temperature of about 95 °F., than under a low temperature of about 50 °F., It was demonstrated that under fluctuating conditions of relative humidity varying from about 50 per cent to about 95 per cent. daily, due to ventilation or other causes, very little development of the callous was observed.

With a condition of uniformly high relative humidity (about 90 per cent.), comparatively little loss of weight in the cured fruits was observed, irrespective of the temperature during storage, and the lemons developed a smoother texture, lighter colour, and better commercial appearance than those where a condition of low relative humidity (70 per cent). was maintained, or where the condition of relative humidity fluctuated over a considerable range during the periods of storage.

Hard ripe Bartlett pears, placed under similar conditions, and held for 30 days at temperatures ranging from 85 to 100 °F., and a relative humidity ranging from 85 per cent. to 96 per cent. remained hard and retained their green colour until the end of the experiment without ripening or deteriorating. The pears kept in a family storage room, where no attempt was made to control either the conditions of temperature or relative humidity turned in a week in colour from green to a golden-yellow, became soft and reached a prime eating condition. The writer believes that the condition of high relative humidity was a controlling factor in retarding the ripening of the pears.

The extraordinary condition of callousedstems, and the perfect preservation of buttons (the calyx) of lemons and the superior commercial quality of the fruit, in the case of lemons stored under uniform conditions of high relative humidity, tend to emphasize the importance of the factor of relative humidity to the storage and ripening of fruits.

Further experiments on the subject are now in progress.

772 - **Temperature Relations of Apple-Rot Fungi.** — Brooks, C. and Cooley, J. S. in the *Journal of Agricultural Research*, Vol. VIII, No. 4, pp. 139-164, text-figs. 1-3, tables 1-III. Washington, D. C., January, 1917.

Rot in stored apples is due to the action of many micro-organisms which after entering the fruit, live first as parasites, only becoming saprophytic

then the increased growth of their mycelium permits them to find, in the decomposed tissues, the substances necessary to their development. These microorganisms are : — *Alternaria* sp., *Botrytis cinerea*, *Cephalothecium roseum*, *Fusarium radicicola*, *Glomerella cingulata*, *Neofabraea malicorticis*, *Penicillium expansum*, *Sclerotinia cinerea*, *Sphaeropsis malorum* and *Vodella fructi*.

One of the best methods of storing fruit is to keep it at a temperature below that required for the development of the micro-organisms. This temperature varies with the fungus, the nature of the medium, the variety and ripeness of the fruit.

This paper deals with rot of stored apples from data obtained by experiments carried out under special low temperature conditions.

The most important results are as follows :

1) All the micro-organisms inoculated into the pulp of healthy fruit grew normally at a temperature of 0° C, except *Fusarium* and *Glomerella*, the former making no growth at 15° and the latter none at 10° C.

2) The optimum temperature is about 25° C., except for *Neofabraea malicorticis* and *Fusarium*, for which it is respectively 20° and 30°; naturally the growth of the fungus is most rapid in temperatures near this optimum. *Sclerotinia cinerea* produces rot at 5° in one week, whereas at 0° two weeks are necessary. Above the optimum, growth drops off rapidly.

3) The effects of low temperature are much more evident during the first stages of the incubation of the fungus than during the saprophytic stage.

Penicillium expansum, when inoculated into rather immature apples which have been put into store a *long time after being picked*, continues to grow at 0°, whereas, at the same temperature, similarly infected, fruit which has been put in store *immediately after being picked* remains perfectly healthy. This behaviour applies to all the micro-organisms under consideration, and shows the importance of immediate storage.

4) The temperature limit also varies with the ripeness of the fruit, increasing as the apples ripen. Thus at 0°, in ripe apples of the York Imperial and Ben Davis variety, *Penicillium expansum* caused rot in 4 weeks, in Yellow Newtown and Winesap that were rather greener, in 8 weeks, but in unripe York Imperial and Arkansas it produced no rot at this temperature even after 18 weeks.

5) The maximum and minimum temperatures may be modified by the media on which the fungi are grown. When inoculated into the Yellow Newton and Winesap varieties, *Glomerella cingulata* does not develop at 10°, nor *Fusarium radicicola* at 15°, but both these microorganisms grow well on corn-meal agar at 5°.

[771] **Refrigerating Establishments in Italy.** — Ministero dell'Interno Direzione Generale della Sanità Pubblica. *Notizie statistiche sui frigoriferi esistenti in Italia al 30 Novembre 1915 per la conservazione delle carni fresche o congelate e degli altri generi alimentari di origine animale*. pp. 105, tables. Rome, 1916.

In view of the great economical and hygienic importance of the cold storage of animal products, particularly of meat, the Italian Department of

Public Health took a census of the refrigerating establishments in the country.

In addition to detailed information, there is a table enumerating all the establishments in each Italian district, province and town up to the end of 1915. This census shows a very rapid growth of the industry during the last ten years.

The greatest number of refrigerating esablishments are to be found in northern Italy, particularly in Lombardy and Piedmont. Throughout the kingdom there are 250 establishments, situated in 150 towns in 46 out of 69 provinces. The provinces of Turin and Milan alone include 1/4 of all these establishments. Central Italy has progressed during the last years but there are still certain provinces devoid of any installation for preserving foodstuffs. The southern districts, Sardinia and Sicily, are in greatest need of refrigerating facilities, in spite of the fact that their warm climate should give an impetus to the development of cold storage.

The greatest number of installations is in the following 9 provinces: Turin (24), Milan (23), Como (20), Bergamo (10), Novara (11), Cuneo (12), Padua (10), Mantua (10), Udine (4). These 9 provinces possess 2/3 of the important refrigerating establishments of Italy, and the greatest number in proportion to their population and area.

As regards capacity, the largest of these establishments (chiefly for frozen meat) are at Genoa, Milan, Naples, Venice, Rome, Bologna and Parma. The most important one is at Genoa, and has a total capacity of 30 000 cubic metres, 2/3 of which are reserved for meat, and 1/3 for eggs, poultry, etc.

Milan has an establishment of about 20 000 cubic metres, used for frozen and chilled meat, lard, poultry, game, butter, eggs dried and salted fish, etc. At the present time about 40 towns have refrigerating establishments attached to the municipal abattoirs.

PLANT DISEASES

GENERAL INFORMATION.

4 - **Decree of the Italian Minister of Agriculture Regulating the Issue of Certificates of Immunity to Growers and Sellers of Plants or Portions of Plants.** — *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 180 p. 3413. Rome, July 31, 1917.

Under date of May 31, 1917, the Italian Minister of Agriculture, in view of the necessity for regulating the issue of certificates of immunity to producers and sellers of plants or of portions of plants, has issued the following decree which entered into vigour on August 1.

Art. 1. — Certificates of immunity (mention of which is made in art. No. 4 of the regulation of March 12, 1916, No. 723 (1) are issued to growers of plants subject to inspection upon payment of a fixed sum proportional to the extent of the area to be inspected.

The sum fixed is 5 lire in cases where the total area to be inspected does not exceed 1 hectare (2.5 acres), and in other cases 5 lire for the first hectare and 3 lire for each remaining hectare or fraction of a hectare.

Art. 2. — The money is to be paid to the Registry Office against a receipt which should be presented by the grower to the Director of the Regional Observatory of Phytopathology who notes in a special register the date of payment, the number of the receipt and the name of the official to whom payment was made.

In no case shall a certificate be issued unless the above-mentioned fee has been paid.

(1) See *B.* August 1913, No. 905, on mesures for the prevention and control of plant diseases. (*Ed.*).

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

775 - **Factors Determining the Occurrence of "Silver-Leaf" on Trees.** — PETRI, L., *Annali del R. Istituto sup. forestale nazionale*, Vol. II, 11 pp., 2 figs, 1 plate. Florence, 1917.

Both in Europe and America a large number of trees are found the leaves of which have a leaded or silvered appearance. The chief anatomical fact underlying this phenomenon, which also explains the metallic sheen on these leaves, is the detachment of the epidermal layer from the palisade tissue, giving rise to an intercellular space. The air penetrates into this space and reflects back the whole of the light falling upon the leaves. An almost invariably observed, but unimportant fact, in these cases is that the epidermal cells are slightly hypertrophied.

This disease, which was initially considered non-parasitic, has since been classed among those of a parasitic nature — apparently definitely — the organism concerned being the basidiomycete *Stereum purpureum*.

The writer's observations, however, show that in some cases leaves with a metallic sheen may occur on orchard or forest trees without concomitant infection of the branches by *St. purpureum* or other microorganisms.

A 3 year-old peach tree grown from seed and pollarded in April 1916 when in full growth, quickly produced a number of stout shoots about 1 cms. from the point where the crown had been removed. These, in turn, produced numerous lateral branches which usually bore leaves whose upper surface showed a white metallic sheen. The silvered leaves appeared by preference upon the lowest branches, their orientation being indefinite. The branches grown nearest to the point where the tree had been cut bore normal leaves. The metallic appearance persisted till the leaves fell at the end of the season.

Observations have shown that the metallic sheen is due to an abnormal accumulation of calcium oxalate crystals in the epidermic of the leaves. The total absence of foreign organisms in the leaves, branches and roots excludes the idea of the abnormal accumulation of calcium oxalate being due to the action of parasites and confirms the supposition that it is an indirect effect of the removal of the crown and the conditions of nutrition of the plant.

A third factor capable of determining the metallic sheen on the leaves is the more or less complete detachment of the cuticle of the upper epidermis.

The writer has recently studied this phenomenon on the leaves of *Viburnum Tinus*, which frequently show a leadish colour over a portion or the whole of their surface. A very thin layer of air is interposed between the cuticle and the pecto-fibrous lamella lying below the external wall of the cells of the epidermis.

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(1) See on this subject *B.* Jan. 1912, No. 249 and *B.* April 1913, No. 331

In the leaves of *Euonymus europaeus* the white metallic sheen is ısed by the detachment of the cutinised layer from the pecto-fibrous nella and by the disappearance of the chlorophyll from the outermost er of palisade tissue.

With regard to the causes underlying such changes, the phenemon is, final analysis, of the same nature as that presented by the typical, para- ic form of the disease ; that is to say, it is due to a process of hydrolysis the pectic substances of the walls of the epidermal cells. It is doubtless e to the action of a pectinase, the formation and abnormal secretion of ich depend upon external influences.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

6 - **Influence of Temperature on the Development of Fungi causing Rot in Stored Potatoes.** — See No. 772 of this *Bulletin*.

7 - **On the Specific Susceptibility of Barley to Leaf Stripe Disease (*Helminthosporium gramineum*).** — KIESSLING, in *Zeitschrift für Pflanzenzüchtung*, Vol. 5, Part 1, pp. 31-40. Berlin, March 1917.

The writer has observed that different varieties of barley are diversely ected by this disease.

At the Experimental Station of Weihenstephan he has examined 29 rieties, the researches lasting over a period of 3 years. The practical nclusions are as follows:

1) The breeder should devote all his attention to studying the sceptibility of his varieties of barley to "leaf-stripe". In order to obtain curate results, he should not only separate the strains in the nursery, but ter on as well, after one or several generations, examine them early and te the plants attacked. In this connection it is not sufficient to search single spot only, because, owing to influences inherent in the constiıtion of the soil, the disease may occur under quite a different aspect in fferent parts of the same area. Further experiments must be continued r several years in succession because experience has shown that climate — pecially high temperatures during and after germination — may modify ie appearance of the disease. Strains which, on different plots and for veral years, show themselves to be fairly susceptible to the disease, should excluded.

2) By crossing pure strains with strains of proved resistance, an ttempt should be made to obtain varieties resistant to leaf stripe.

3) As the spread of the disease depends primarily upon the degree f infection of the locality where the seed has been produced, and as the posıibility of infection varies markedly according to the nature of soil and cliıate, sowing a barley derived from localities and soils frequently or rongly infected by leaf stripe should be avoided.

4) In addition to infection by germs from the soil and by fungi adher-

ing to the grain, infection of the flower by *Helminthosporium gramineum* Rabenh. also occurs; a good method of reducing the danger of infection is to remove infected plants from the nurseries or breeding plots at an early date in the same way as with smut.

5) In order to prevent the flower from becoming infected, it is advisable to sort the grain carefully as it is the spikelets from the upper portion of the ear which flower late and give small seed which are most exposed to infection.

6) For direct control of the disease, besides the employment of immune plots, recourse may also be had to immediate treatment of the seed. In the majority of cases it is sufficient to destroy the fungi adhering to the grain by means of the usual methods (copper sulphate, mercury salts, formalin etc.), but, owing to infection of the flower, complete destruction of the pest is impossible. It is necessary in consequence, to combine the heating process (hot water or air, with swelling of the grain) with the chemical process, in this way both kinds of smut may be destroyed. Establishments concerned with the production of seed grain situated in districts suffering from leaf-stripe should only sell their seed to farmers after it has been treated. Later infection of the seed by the soil could be prevented by the employment of copper solution with the addition of lime, according to TUBEUF's formula; with this method a sort of crust is formed at the surface of the grain.

7) The officers whose duty it is to keep the peasants informed as to what varieties to use etc. and to conduct experiments should, in future, direct greater attention to the specific behaviour of barley with regard to leaf-stripe; if possible, they should exclude from the market all varieties which, for a long period and in different localities, have proved to be more suceptible to the disease than the remainder. Further, public cooperative bodies should examine the crop in order to determine definitely whether they are diseased; this inspection should be carried out when the plants are green.

778 - ***Sclerotinia Matthiolae* n. sp., Parasitic on *Matthiola valesiaca* and other Cruciferae, in Switzerland.** — CENDNER A., in *Bulletin de la Société botanique de Genève*, 2nd. Series, Vol. IX, No. 1-3, pp. 21-29, figs. 1-3. Geneva, 1917.

In 1916, some specimens of *Matthiola valesiaca*, cultivated near Geneva were attacked by a disease in which the inflorescences suddenly withered and the petals changed from their original violet colour to red, as if they had been acted upon by an acid. The plants attacked soon died.

The disease appeared also upon other Crucifers, such as *Aubrietia* (fairly seriously), *Biscutella*, *Erysimum*.

Within the stems of the sick *Matthiola* plants there was found a small black sclerotium.

Microscopical examination and experiments with artificial cultures showed that the withering phenomen is to be attributed to a species of *Sclerotinia*, described as new to science under the name of *Scl. Matthiolae*, and as closely related to *Scl. libertiana* and *Scl. lanacis*.

79 - ***Didymella applanata*, a Sphaeriaceae Parasitic on the Raspberry in Switzerland.** — OSTERWALDER, A., in *Schweizerische Obst- und Gartenbau-Zeitung*, No. 12, pp. 175-177, 1 fig. Münsingen, 1917.

The disease of the raspberry, already recorded in Switzerland (1) and easily recognisable by the reddish brown or purple patches which appear on the branches, developed, during 1916, to a very considerable extent.

New observations, confirmed by experiments on artificial infection, have shown that the fungus which penetrates the young stems and causes the patches is the ascomycete *Didymella applanata*.

As the young stems of some cultural varieties of the raspberry ("Harzwel", "Baumfoorh's Sämling", etc.) show a waxy whitish investment, the writer recommends increasing the adhesiveness of the Bordeaux mixture by adding a solution of soft soap so that the spraying mixture contains 2 % of this latter and 1 ½ % of copper sulphate.

WEEDS AND PARASITIC FLOWERING PLANTS.

80 - ***Scorzonera laciniata*, a New Weed in Southern Australia.** — ANDREW, H. W., in *The Journal of the Department of Agriculture of South Australia*, Vol. XX, No. 7, pp. 557-558, 1 fig. Adelaide, 1917.

A description of the Composite *Scorzonera laciniata* C. (= *Podospermum laciniatum* D. C.) This weed was found in 1916 on neglected farm land at Collinswood, in the Council of Prospect district. Judging by its present distribution it has been established there for several years past; it appears to be confined to this locality.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

81 - **New Mites, mostly Economic (Arach., Acar.).** — BANKS, N. in *Entomological News*, Vol. 28, No. 5, pp. 193-199, plates XIV-XV. Philadelphia, May, 1917.

The following should be noted:

1) *Notophallus viridis* n. sp., found on wheat at Tempe (Arizona) and at Wagoner (Oklahoma);

2) *Tetranychus antillarum* n. sp., on leaves of *Iconotis nepetaefolia* and on *Asclepias curassavica* at Rio Piedras (Porto Rico);

3) *Tetranobia decepta* n. g. and n. sp. on barley at Mesa (Arizona);

4) *Tetranychina apicalis* n. g. and n. sp., and on white clover, at St. Bernard (Louisiana);

5) *Stigmaeapsis celarius* n. g. and n. sp., on leaves of *Bambusa Metake* at Oneco (Florida);

6) *Tyroglyphus sacchari* n. sp., on sugar cane, in the island of St. Croix.

7) *Chorioglyphus gracilipes* n. sp., on tobacco infested with *Lasioderma serricorne* (cigarette beetle) at Tampa (Florida).

(1) See *B.* Feb. 1916, No. 249. (*Ed.*)

782 - **Relation between Climate and Life-Cycle of the Tussock Moth (*Liparis monacha* = *Lymantria monacha*).** — SEDLACZEK, in *Oesterreichische Forst- und Jagdzeitung*, Year 34, No. 44, pp. 259-260. Vienna, 1916.

During the period 1906-1915, the writer has made careful observations on the multiplication of the Tussock moth in relation to the climate. He has discovered that the transformation of this moth from chrysalis into perfect insect takes place at very different periods; sometimes the moths begin to fly during the first half of July and at others during the last days of August, according to locality and climate. Later researches have shown that the majority of these moths only completed their development when the aggregate daily temperature, calculated from the 1st of May, reached 1500° C.

The moth only flies on calm evenings with a temperature of 15° C. or above; never during rain. In Bohemia, however, the total temperature of 1500° C. is sometimes reached as early as the first half of July, sometimes towards the end of August; in the mountains it is reached still later. Evenings without wind or rain are relatively more frequent in Bohemia during the months of July and August; during September they are rare and in the mountains at this time such evenings never occur. The earlier therefore, the necessary sum-temperature is obtained, the greater the time the moth has at its disposal for flying, and vice versa. If, for example, in the mountains this sum-temperature is only reached in September, the insects have no longer many evenings left for flying. As fertilisation of the female takes place chiefly on such evenings, it is obvious the propagation of the insect must suffer in consequence. The writer has observed that after years with 12 evenings favourable to flight, the moth has multiplied to a much greater extent than after years with a smaller number of favourable evenings; this explains why it does not breed to any very great extent in the mountains.

It would be wrong, however, to believe that the appearance of the moth is merely in relationship with the climate; parasites and disease are also concerned.

The writer's conclusions — which agree in the main with those of FEDERBAUER — are as follows:

1) The "tussock moth" requires for its post-embryonic development a sum-temperature of 1500° C. In any given place the moths only appear in great numbers when this total has been reached.

2f The nuptial flights take place on fine, windless evenings, when the temperature is above 15° C. An increase in the numbers of the moths was noticed after years in which there were at least 12 favourable evenings during the flying period.

3) The flying period commences, therefore, when the sum-temperature of 1500° C. has been reached, and ends when no more evenings occur with a temperature of 15° C. In districts where the two epochs are very close together, the appearance of the moths in any great numbers is out of the question. The same thing is true after years when the period between the two epochs has been marked by cool, rainy or stormy weather.

Notes on Coccid-infesting Chalcidoidea (1). — WATERSTON, J., in the *Bulletin of Entomological Research*, Vol. VII, Part. 4, pp. 311-325, figs. 1-7. London, May, 1917.

This list includes:

1) *Coccidoxenus distinguendus* n. sp. reared from *Lecanium* and *L. hemispaericum* Newst. n. sp., both living on the coffee-tree at Aburri, ld Coast).

2) *Aethognatus afer* Silv., obtained from *Stictococcus diversiseta* Silv., Aburi.

3) *Aeth. afer*, var. *cavilabris* n. var, taken from *Stict. dimorphus*, at ebbe (Uganda).

4) *Eusemion cornigerum* Walk., obtained from *Parafairmairia gra-* s at Camberley (Surrey).

5) *Habiolepis apicalis* n. sp., obtained from *Chionaspis minor* at Aburi.

6) *Aspidiotiphagus citrinus* Craw., obtained from *Chion. graminis* Peradeniya (Ceylon); from *Aspidiotus camelliae*, at Salisbury (Rhodesia) m *Chion. minor* at Aburi.

7) *Eriaporus laticeps* n. sp. taken from a scale insect living on the oa-tree at Aburi.

Rhyssa persuasoria and Ephialtes manifestator, Hymenoptera Useful to Forestry. — BORDAS L., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 164, No. 24 (June 11, 1917), pp. 923-925. Paris, 1917.

Among the Ichneumonidae protecting forest trees (spruce, pine, oak, etc.) ainst injurious insects, special mention must be made of the genera yssa Graven. and *Ephialtes* C., subfamily *Pimplinae*.

Rhyssa particularly attacks the larvae of Siricidae (*Sirex*) and *Ephialtes* se of various Buprestids and Cerambycidae (*Callicium*).

One of the best defenders of coniferous trees is *Rh. persuasoria* which is lly common among pines, larch, spruce, etc., the female flying along the nks and branches on the look out for the *Sirex* larvae in the galleries red in the wood. When ovipositing, the female carefully pushes her ovi- sitor into the gallery, pierces the dorsal integument of the young larva d deposits her eggs in the body cavity above the gut. Egg-laying con- nues until the contents of the ovary are exhausted; the female makes a inimum of 12 layings and sometimes 24 to 36 layings, so that a single nale in the course of a season destroys from one to several dozen larvae.

Rh. persuasoria possess well developed poison glands of character- ic size and shape. They include two organs: acid or multifid glands and kaline or tubular glands; there is also a poison sac and an excretory nal. These organs must play a considerable part in the preservation of e species; the liquid injected into the *Sirex* larva at the time of egg-laying ust have anaesthetic and preservative properties which prevent the issues of the larva from decaying.

Ephialtes manifestator has a blackish body with the front two pairs legs reddish and the back pair inclining to black. The female, with the

(1) See also *B.* April 1917, No. 392. (*Ed.*).

aid of its long and flexible ovipositor lays her eggs in the larvae of certa Cerambycidae (*Callidium*), which live in galleries bored in the wood o trees. The egg hatches out in the larva, the latter being thereby kille

785 - ***Ceratomyza femoralis*** **("Wheat-sheath Miner"), a Dipterous Pest Wheat.** — SEAMANS, H. L., in *Journal of Agricultural Research*. Vol. IX, N pp. 17-25, fig. 1. Washington, D. C., 1917.

Ceratomyza femoralis (= *Agromyza femoralis* Meigen) is record from Europe and the American Northwest States. In Montana it wa reared from winter wheat, spring wheat, oats and timothy. As this inse has only been found on graminaceous plants, it appears that native gra ses may be its natural host.

A detailed description is given of egg, larva, puparium and pupa, an adult.

A field of wheat infested with the wheat-sheath miner may not appea to be greatly injured, unless badly infested. Close examination is nece sary to estimate the real damage. Injured culms are easily recognize by the fact that while the leaves are mostly green and healthy, the centr stalk is dead and withered. The larva bores down the leaf sheath in narrow clean-cut, and almost straight channel. The larva usually confin itself to mining in the leaf sheath and sometimes girdling the ste without cutting it off. The injuries caused by the mining are sufficie to kill the stalk. Several estimates of the damage caused by the pest i 1915 resulted that the yield of winter wheat had been cut down 25 per cen

The second brood of the larva causes some slight injury to the plan just before flowering but this injury has little effect on the yield.

The adults emerged (under experimental conditions) from betwee July 11 to July 24 in 1915, when the females fed by making incisio on the leaves and feeding on the exuding juices. The males appear t feed only on pollen. Oviposition lasts 10 days and probably longer i the field. An average for the number of eggs laid in 24 hours was foun to be 16 eggs per fly. The egg is laid under the leaf-epidermis in a punc ture formed by the ovipositor. The eggs hatch in about 6 days and th larval period appears to last about 20 days, depending on weather con ditions. The pupal stages (also under experimental conditions) last abou 25 days. There seem to be three full broods a year with the hibernatio spent as a pupa. The last brood has not been actually reared, but it presence is deduced from various facts.

Two hymenopterous parasites were reared from the puparia of *femoralis*, namely a new species of *Dacnusa* (Braconidae) and *Cyrtogast occidentalis* (Chalcididae). Their control value is uncertain.

As a practical measure of control, burning the stubble as well as th grass borders of the field is suggested, or alternatively, plowing it unde and harrowing.

Late seeding, together with the above measure would be useful, a the grain would not be up till oviposition was nearly over.

The wild grasses, being hosts of the pest, should be kept down.

786 - **On Some Rhynchota of Economic Importance from Colombia.** — DISTANT W. L. in the *Bulletin of Entomological Research*, Vol. VII, Part. 4, pp. 381-382, pl. IV. London May, 1917.

The list includes: *Trichocentrus gibbosus* How. (?) and *Collaria oleosa* Dist., both injurious to rice fields: *Monalonion atratum* Dist. var. *M. illustris* n. sp. (*M. atratum* var.?), *M. megiston* Kirk and *M. collaris* n. sp., injurious to cacao pods in Colombia.

787 - **The Horse-Radish Flea-Beetle (*Phyllotreta armoraciae* Koch): its Life History and Distribution.** — CHITTENDEN, F. H. and HOWARD, NEALE F., in *United States Department of Agriculture. Bulletin* 535, pp. 1-16, fig. 1-6. Washington, D. C., 1917.

The growing of horse-radish in the North of the United States is menaced by the introduction from Europe of a small Coleopteron known as the horse-radish flea-beetle. The beetle is oval in outline, about 1/8 th.of an inch long with yellow elytra bordered with black, and with a longitudinal black band through the middle. The larvae bore into the petioles of horse-radish, and the adults feed on the leaves and gouge deeply into the midribs, causing drying and death.

The beetle was first recognised in U. S. A. at Chicago, Ill., in 1893, since which time its area of distribution has increased until it now occurs from New York and New Jersey to Quebec, Canada, and westward to Nebraska.

The species passes the winter in hibernation as a beetle, coming forth in its northern range in April and May.

While as yet destructive only to horse-radish, its capabilities of becoming a pernicious pest, should it adapt itself to the economically more important cruciferous crops, must be acknowledged, and measures should be taken for its suppression wherever possible.

No systematic control programme has been adopted as yet. Bordeaux mixture, a powerful repellent against flea-beetles, applied on the first appearance of the insect will prevent much injury, and if arsenate of lead is used later it should hold the insect in check.

When a new bed is to be planted a location should be chosen as far removed as possible from any infested bed. It is advisable also to destroy all volunteer plants, not only to keep the insect in check but in some cases to suppress them as weeds.

788 - **Notes on the Black Apple Leaf-Hopper (*Idiocerus fitchi* Van D.).** - BRITTAIN, W., H. AND SAUNDERS, L. G., in *The Canadian Entomologist*, Vol. XLIX, No. 5, pp. 149-153. Plate IX. London, May 1917.

This insect was first described by FITCH as existing in New York State, but seems to occur generally in the North-eastern United States and Canada. It is also very common in the Annapolis Valley of Nova Scotia.

Contrary to the opinion generally held it has been proved experimentally that *Idiocerus fitchi* Van Duzee does not do serious damage to fruit trees, and that even a large number of these insects in an orchard does not justify the alarm sometimes caused by their appearance.

A description is given of the different life stages of the insect.

FITCH records this species as living on *Crataegus* and OSBORNE mentions it on *C. Oxyacantha* and on crab. In Nova Scotia it is very common on apple and pear trees in spring and early summer.

The eggs begin to hatch several days before the apple blossom petals open and continue for some time after their fall, that is to say, generally from the latter part of May to the beginning of June. The nymphal stage lasts from 7 to 8 weeks. Some days after emergence copulation takes place, and, shortly after this, the eggs are laid. By means of her beak the female makes a hole, usually in the fruit spur, or in a roughened surface on one of the smaller twigs, and deposits an egg therein. There is only one brood a year, the winter being spent in the egg stage.

A bibliography of 8 references is given.

789 - ***Mesolecanium deltae* n. sp. a Gall-forming Scale Insect observed upon Species of Citrus.** — LIZER C., in *Broteria, Série zoológica*, Vol. XV, Part II, pp. 103-107, figs. 1-5. Braga, 1917.

In the neighbourhood of Buenos-Aires and especially in the region of the Paraná delta one often sees upon the leaves of species of *Citrus* a scale-insect which, by means of its punctures, forms little depressions on the lower surface of the leaf with corresponding small swellings upon the upper surface. Within the gall so formed the insect lays its eggs.

When several individuals of the scale insect occur upon the same leaf, this latter takes on a yellowish green colour. When attacked by a single insect the leaf becomes slightly curled ; this curling is more pronounced the more numerous the parasites (as many as 25 of the scale insect have been observed upon the same leaf).

This gall-forming insect is described as new to science under the name of *Mesolecanium deltae*. The females, the males not yet being known, are attacked by a microhymenopteron; the writer has observed as many as 5 pupae upon a single scale-insect, but has not yet been able to obtain the perfect insect.

RUGGERI ALFREDO, gerente responsabile.